RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

EDITOR

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Detroit, Michigan

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Early Roentgenologic Changes in Idiopathic Ulcerative Colitis[1]

TOUFIC H. KALIL, M.D., and LAURENCE L. ROBBINS, M.D.[1]

Boston, Mass.

THE EARLY RADIOLOGIC diagnosis of idiopathic ulcerative colitis is difficult. Although it should be recognized that the roentgen changes are usually not apparent until the clinical findings are well established, it is important that the roentgenologist be aware of the earliest manifestations by which the diagnosis may be made, especially in those cases in which the lesions are not visible by means of sigmoidoscopy, or in which for some reason sigmoidoscopy has been omitted from the examination.

The usual roentgenologic description of ulcerative colitis applies to the late stages of the disease, that is, absence of haustration, producing the "lead pipe" effect, shortening of the colon, rapid filling and emptying, shagginess of outline, pseudopolyposis, and fibrosis and rigidity of the wall. A few references to a disordered mucosal pattern, visible on the post-evacuation roentgenogram, are to be found in the literature, but with rare exception only the moderately advanced to advanced stages of the disease are described. Kadrnka and Audéoud (1) are among the few who have observed changes of a somewhat earlier phase. They speak of a marbled pattern and gross dentate appearance of the border of the large bowel, and, by using a colloidal preparation, they found that a finely granular aspect, suggestive of small ulcerations, could be produced on the post-evacuation roentgenogram. Knothe (2) also noted, in addition to the well recognized lack of haustration and rapid filling and narrowing of the colon, a regular fine dentation of the border which he considered a sign of vagal irritation. This appearance could be produced experimentally by the external application of cold or by the administration of pilocarpine; it could be reversed by the use of atropine. It was evident also, Knothe found, in patients with local irritation such as is caused by "mucous colitis" and in others who had peptic ulcer, pelvic inflammatory disease, prostatitis, appendicitis, distant tuberculosis, diverticulitis, and carcinoma of the colon. He concluded that it is an irritative rather than an inflammatory phenomenon.

Hodges (3) describes minute serrations on the edge of the filled colon as evidence of diffuse small ulcerations. In a recent review, Ricketts, Kirsner, and Palmer (4) found that in 60, or 39 per cent, of 156 patients with ulcerative colitis the findings on the first roentgenologic examination were normal.

In the great majority of cases, ulcerative colitis is of the ascending type, beginning in the rectum and sigmoid and extending proximally toward the cecum; it is in the

[1] From the Department of Radiology, Massachusetts General Hospital, Boston 14, Mass. Accepted for publication in May 1948.

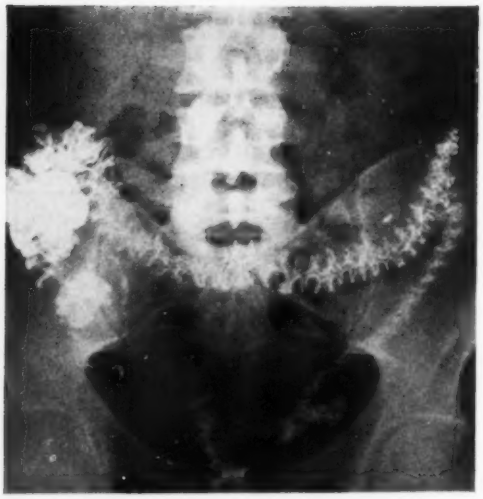


Fig. 1. Normal mucosal pattern as seen on the post-evacuation roentgenogram. Note the irregular, close-set, crinkly folds becoming more longitudinal as the rectum is approached.

rectum and sigmoid, therefore, that the earliest roentgen changes may usually be found. On the other hand, de Castro Barbosa, Bargen, and Dixon (5) reported a selected group of 140 patients in whom the rectum and sigmoid were free of disease, the colitis being regional and segmental.

In an attempt to establish roentgenologic changes that might be considered characteristic of colitis in an earlier phase than has heretofore been emphasized, the roentgenograms of 160 patients at the Massachusetts General Hospital with idiopathic ulcerative colitis were carefully studied. The group included no case in which the diagnosis had not been established by sigmoidoscopy, colectomy, or autopsy; it included all phases of the disease, from a few weeks duration to the far advanced stage (in some instances carcinoma had been superimposed). In the serial roentgenograms that were available, development and progression of the process in a given patient were shown. As a result of this study, certain criteria are presented which seem to indicate the earliest roentgen signs of idiopathic ulcerative colitis.

TECHNIC OF EXAMINATION

As in all studies of the colon, it is essential that the bowel be well prepared. Frequently castor oil is not given to the patient suspected of having colitis, as he has a very active diarrhea, but, from the radiologist's point of view, it should be used in all patients who can possibly tolerate it. If castor oil is not used, consideration should be given to the administration of compound licorice powders. Saline cathartics should not be used, as these agents have long been known to be valueless in preparation for colonic studies. Enemas may or may not be given, depending upon the adequacy of the cleansing brought about by the catharsis. If the patient is so acutely ill that catharsis is contraindicated, several saline enemas may produce fairly satisfactory preparation of the colon.

Fluoroscopy is, of course, essential in the examination. In patients in whom the caliber of the bowel is smaller than normal, filling appears to be very rapid, whereas if the bowel is larger than usual, as in the patient in whom the disease is of short duration, filling is slower. In any patient whose history or fluoroscopic examination suggests the possibility of ulcerative colitis, spot films of very brief exposure should be taken of the sigmoid and transverse colon. The conventional postero-anterior roentgenograms are taken before and after emptying the colon, with a high kilovoltage and short exposure, usually less than half a second. The film of the filled colon is particularly valuable in demonstrating one of the signs of early abnormality to be described. The post-evacuation film gives the only adequate demonstration of the mucosal relief and therefore constitutes an essential part of the examination.

The contrast medium has consisted of the usual mixture of barium, agar substance, and water. It has not been found necessary to use any of the colloidal substances for demonstration of the important signs of ulcerative colitis.

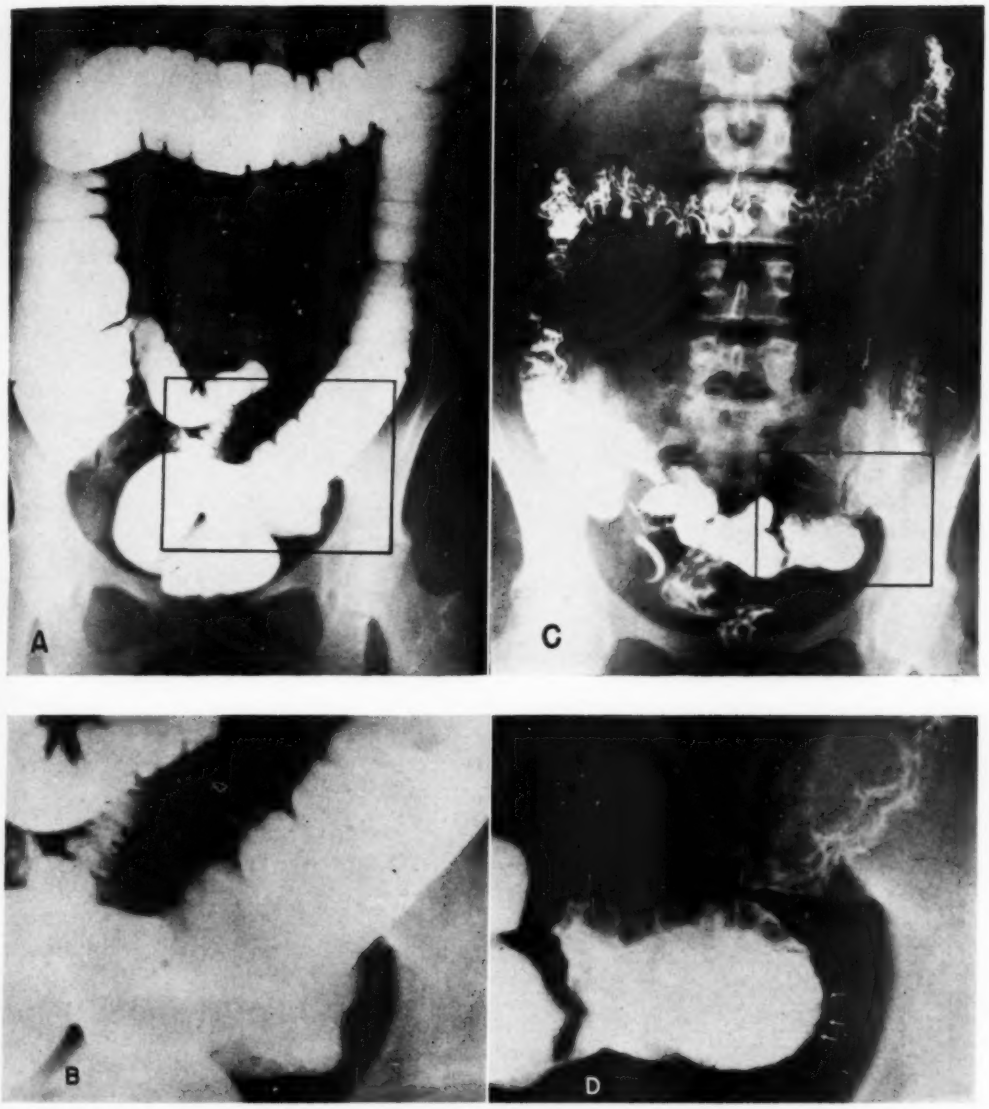


Fig. 2. Case of R. J., a 30-year-old woman, with diarrhea and bleeding of five months duration. *Roentgen examination:* A. The filled colon shows no evidence of ulcerative colitis. B. Enlargement of the sigmoid area shown in A. C. Post-evacuation roentgenogram at the same examination. D. Enlargement of the sigmoid area shows the scattered serrations (arrows) along the edge of the bowel and the well advanced mucosal swelling, typical early signs of the disease.

ROENTGEN APPEARANCE OF THE NORMAL COLON

The well prepared colon, when full, shows sharply defined margins. If a small amount of retained fecal material is adherent to the wall, there are irregularities, but these protrude into the lumen rather than extend beyond the margin, and because of this can usually be differentiated from small ulcerations. After evacuation the appearance of the normal colon is that of crinkling, with some irreg-

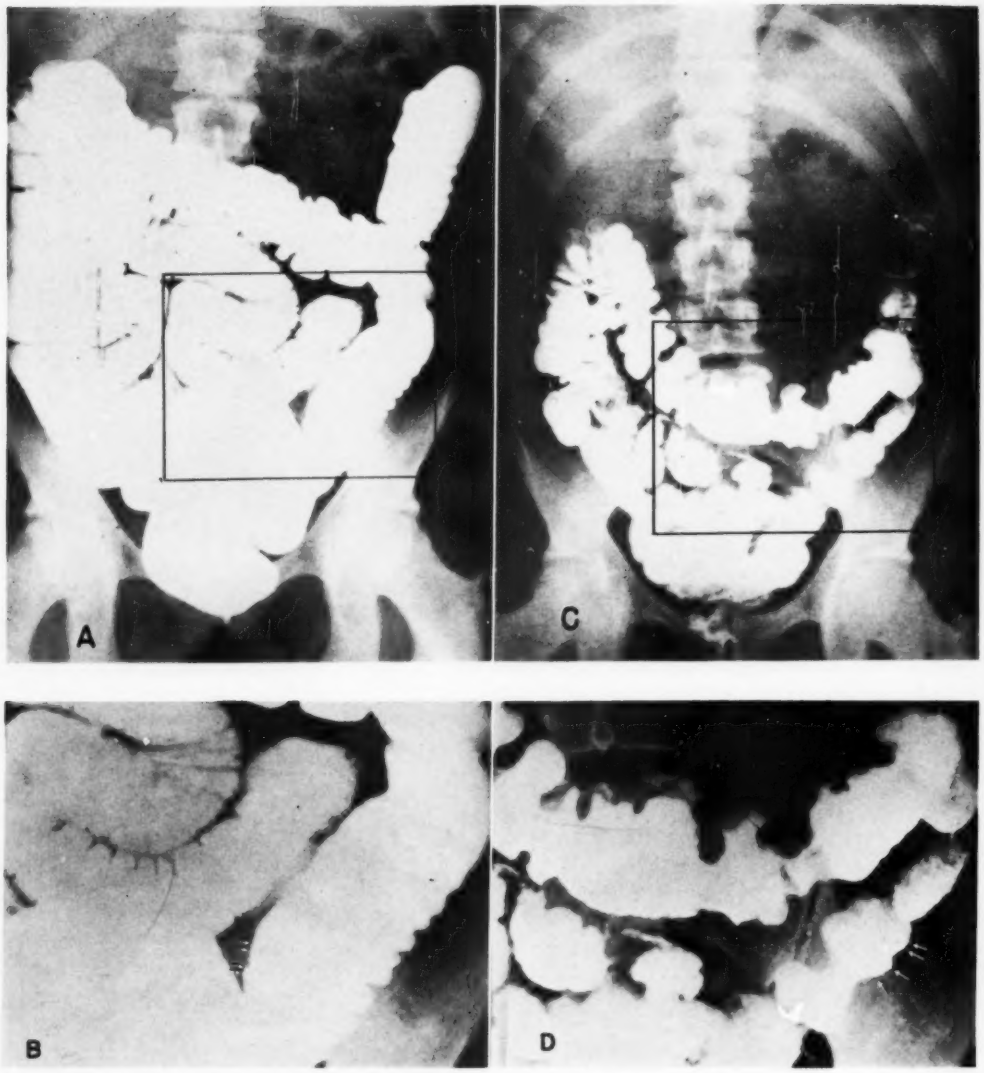


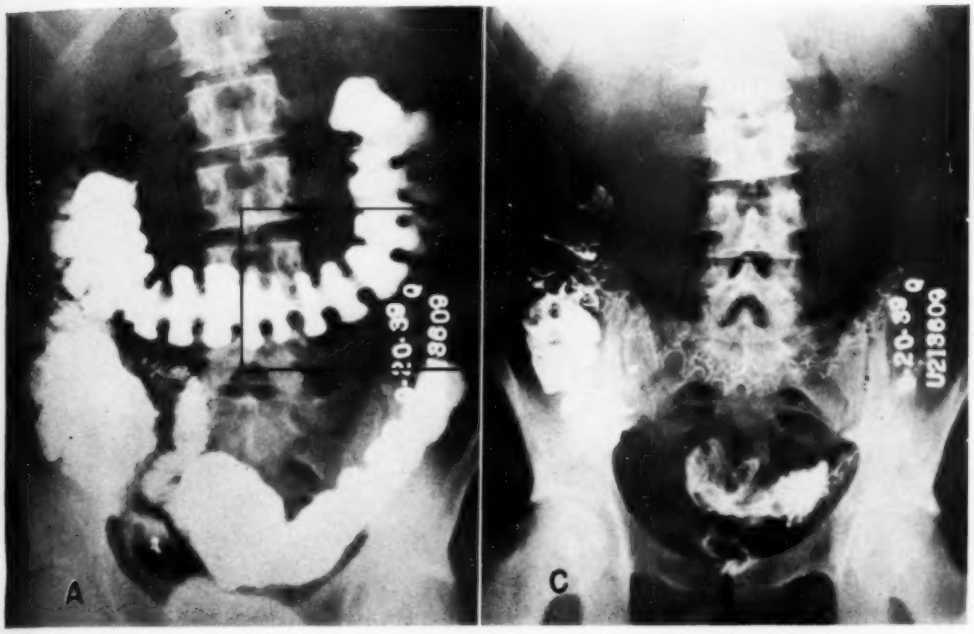
Fig. 3. Case of W. W., a 24-year-old man who had had three short episodes of diarrhea and bleeding in the six years prior to admission.

Roentgen examination: A. The filled colon shows none of the usual signs of ulcerative colitis. On close inspection, minute serrations will be observed along the medial margin of the lower descending colon and the sigmoid. B. Enlargement of this area. C and D. Post-evacuation roentgenogram at the same examination shows only partial emptying, and the sharp serrations of the same segment noted in B are well marked. Incomplete emptying prevents visualization of the mucosal pattern.

ularity of the familiar, well arranged pattern; there are longitudinal folds caused by the taeniae, transverse or haustral folds, and secondary small folds of the mucosa alone, produced when the musculature of the bowel wall and the mucosa contract, the minor folds radiating for short distances in all directions. The rectum is an exception, only longitudinal folds being apparent (Fig. 1).

ROENTGEN APPEARANCE OF THE COLON IN IDIOPATHIC ULCERATIVE COLITIS

The early gross pathologic changes of



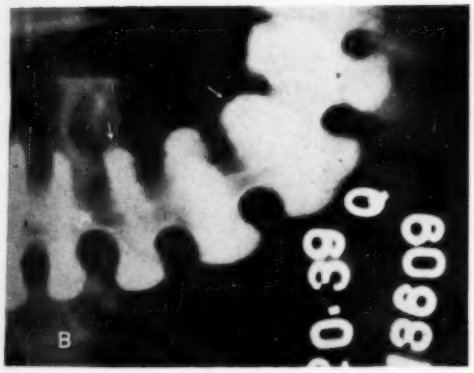


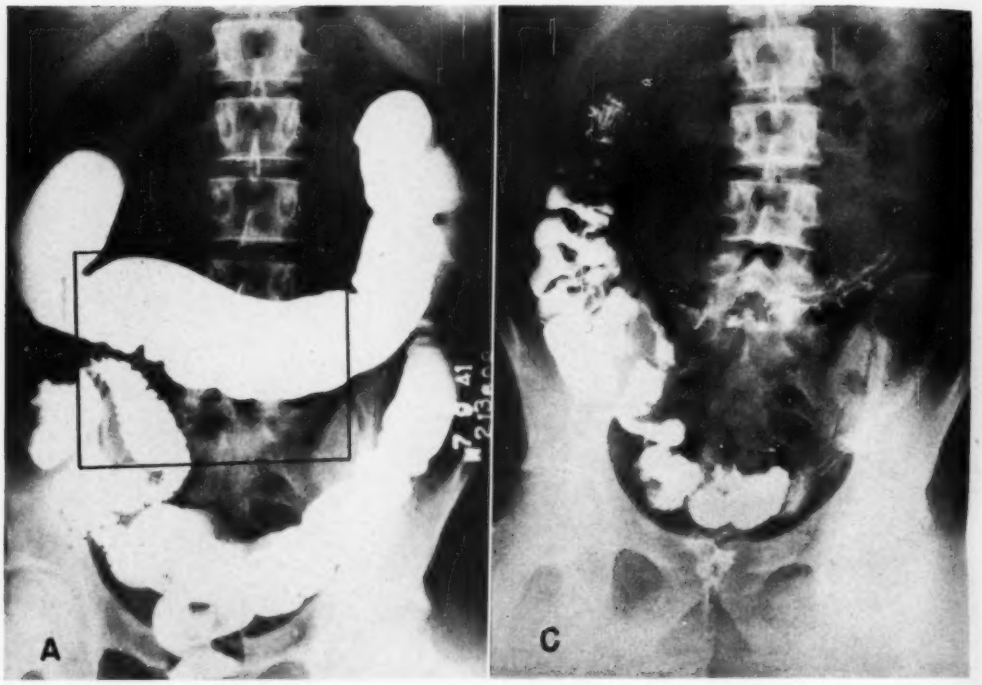
Fig. 4. Case of J. N., a 19-year-old boy with bleeding and diarrhea following appendectomy ten months before admission.

Roentgen examination: A. The filled colon shows, on close inspection, a few small serrations along the upper margin of the distal transverse colon. B. Enlargement of this area. C. The post-evacuation roentgenogram shows considerable mucosal swelling throughout the transverse and descending colon.

See also Fig. 5.

ulcerative colitis include edema and swelling of the mucosa accompanied by very small ulcers. Roentgenologically the first corresponding change suggesting the diagnosis is a difference in the appearance of the mucosal folds; they seem coarser and tend to become parallel, in contrast to their normal irregularity of pattern. These changes, demonstrable on the post-evacuation roentgenogram, are not pathognomonic of ulcerative colitis, since any irritative process such as repeated catharsis may produce enlarged mucosal folds. In true ulcerative colitis, however, the initial abnormalities are followed by superficial ulceration of the involved lymphoid follicles. On direct visualization, these appear as pinpoint to pinhead erosions, producing the familiar pale, granular, easily bleeding mucosa. For accurate roentgen diagnosis, therefore, demonstration of these shallow tiny ulcers is necessary.

In the well prepared bowel, barium filling at this early stage will show, on close inspection, scattered minute serrations in the involved areas, often seen best in profile in the sigmoid and transverse colon since these segments lie nearest the film in the customary postero-anterior projection. As the disease progresses, serial roentgenograms reveal extension of the ulcerative process, producing multiple instead of occasional serrations, so that the



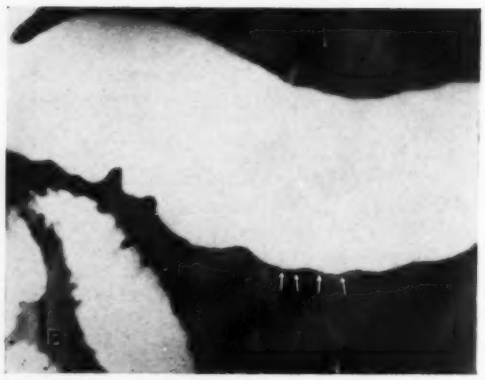


Fig. 5. Same patient as Fig. 4.
Roentgen examination two years later. A and B (enlargement of proximal transverse colon) show progression of the disease, the serrations now involving practically the entire transverse colon. C. Post-evacuation roentgenogram. The mucosal thickening has increased and there is a tendency toward straightening of the folds of the upper sigmoid and descending colon.

entire colon, including the rectum and sigmoid, will show involvement of varying degrees in films of good quality taken at a speed fast enough to offset intra-abdominal movement. Care must be taken in distinguishing between these tiny serrations and small irregular defects caused by particles of retained feces adherent to the bowel wall. On the post-evacuation film the serrations may persist; they are best noted if emptying has been incomplete. This fact suggests that overfilling of the bowel with barium early in the disease can stretch the mucosa sufficiently to efface the minute irregularities but coats the bases of the ulcerations so that after partial emptying the irregularities become evident.

On the post-evacuation roentgenogram, also, the mucosal folds appear markedly thickened and diminished in number; often in the severely involved portions longitudinal folds only are evident. (When the proximal colon is involved, this is not apparent until the disease is far advanced.) The thickened mucosal folds and the small serrations may be clearly visualized either early or late in the course of the disease; in the group studied they were apparent in patients who had shown clinical evidence of colitis from two and a half months to a year or longer. Regardless of the clinical duration, however, the demonstration of

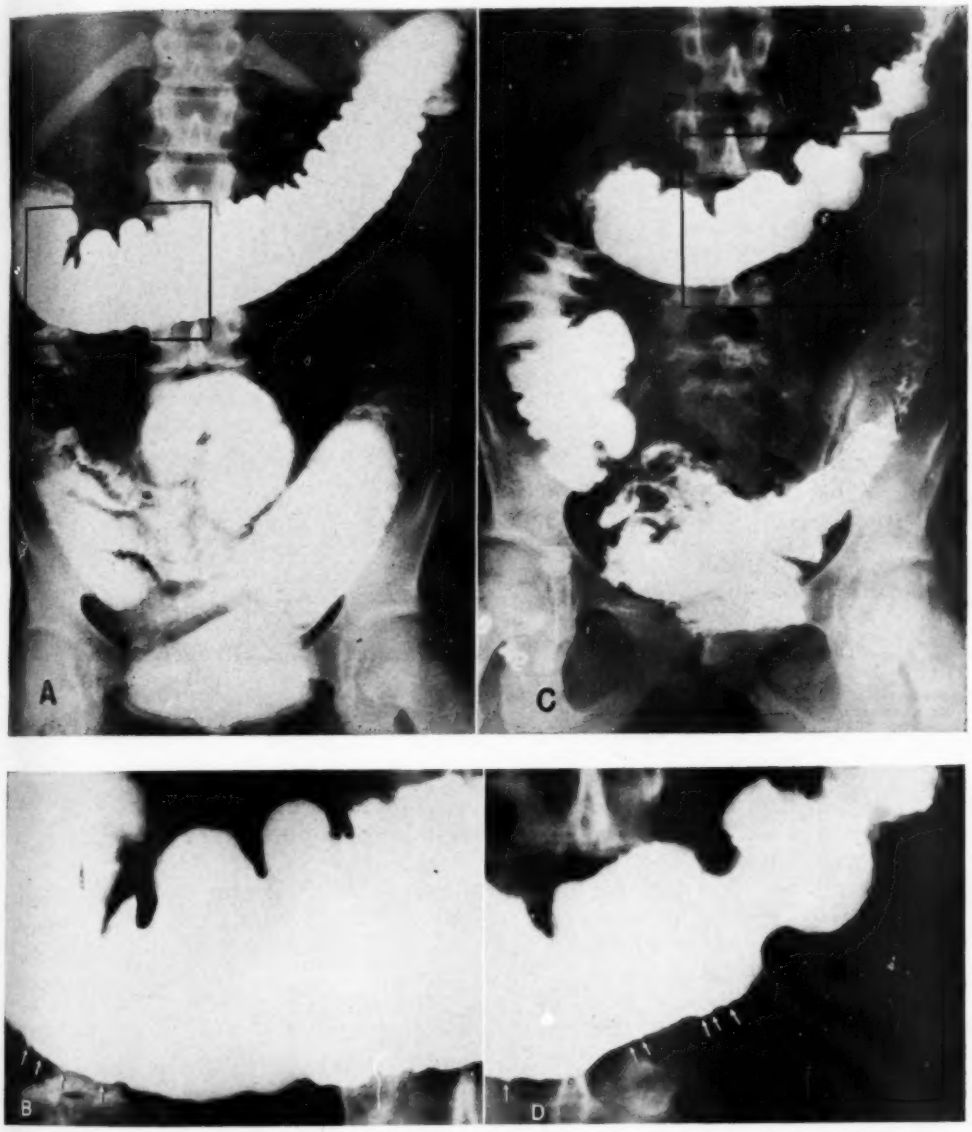


Fig. 6. Case of P. di G., a 21-year-old girl with diarrhea, cramps, and occasional bleeding of three months duration.

Roentgen examination: A. The filled colon, in spite of a large amount of retained contents, shows the typical fine serrations consistent with an ulcerative process. These are best seen along the lower border of the proximal transverse colon. B. Enlargement of this area. C. Extension of the process is evident three months later, with deepening and increase in the number of ulcerations. These are best seen in the enlargement D. Note also the mucosal swelling of the descending colon.

mucosal thickening and scattered minute serrations of the margins of the bowel, when occuring together, are in our opinion the earliest conclusive signs of ulcerative colitis (Figs. 2–5).

Roentgenologically these early signs of colitis progress, and the number of serrations gradually increases (Fig. 6). When of sufficient number, they are visible not only along the margins but may be seen

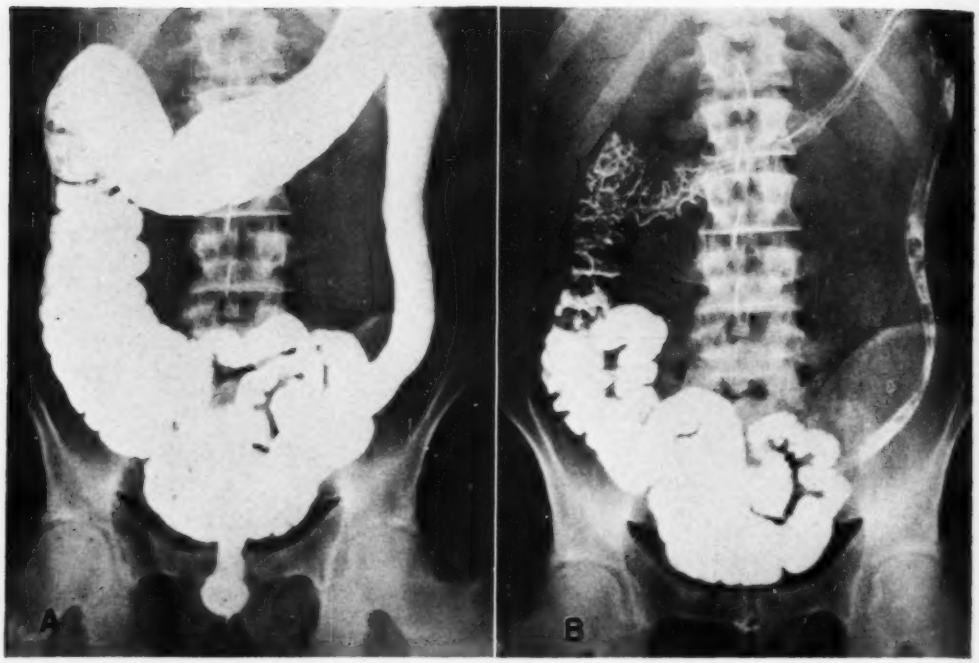


Fig. 7. Case of J. D., a 30-year-old man with bleeding and diarrhea of three years duration.
Roentgen examination: A. In the roentgenogram showing the filled colon, there is evidence of moderately advanced ulcerative colitis. Note the evenly serrated edge of the transverse colon. B. Post-evacuation roentgenogram. The longitudinal bands begin rather abruptly in the proximal transverse colon and extend distally. There is mucosal swelling proximally, but this is insufficient to cause straightening of the folds.

en face as stippling, due to barium filling of the tiny erosions. The routine examination in patients suspected of having idiopathic ulcerative colitis does not include double-contrast studies because of the risk of perforation. It is frequently not possible to make the diagnosis by fluoroscopy, and it is usually safer to avoid introduction of air until an accurate study of the roentgenograms has been made. In those cases, however, in which air is by chance present or has been introduced, the stippling is particularly clear. Further straightening of the mucosal markings develops, so that a minimum of the transverse folds is seen, the result being the continuation of the longitudinal folds of the rectum into the proximal colon (Fig. 7).

As the disease progresses, there are deepening and widening of the ulcers, which may remain limited by the muscularis or may penetrate through it to form a submuscular abscess, giving the "collar-stud" appearance. The presence of a large number of these deep ulcers gives a double-wall effect, the inner wall being outlined by mucosa, the outer wall by barium contained in the bases of the deep ulcers.

The term "pseudo-polypi" has a confusing connotation. It is used to mean edematous mucosa between areas of ulceration in the severe, acute phase of the disease, and it is also used to describe fibrous tabs of tissue frequently seen in the late or inactive phases. When the ulcers have become deep enough, these pseudo-polypi are seen as islands of non-ulcerated, swollen mucosa apparently projecting into the barium column; they are most marked in the presence of deep, submuscular ulcers (Fig. 8). Fibrous tabs remaining after the destruction of the mucosa may have a similar roentgenologic appearance. Sometimes either type may be difficult to

differentiate from true polyposis; in the latter, however, there is usually preservation of some of the mucosal pattern, the polypi are more numerous and vary markedly in size.

Advanced stages of colitis are manifested by extension of the longitudinal folds throughout the colon, if any mucosa remains, or by a loss of all mucosal pattern except for the defects caused by the pseudopolypi. In the final phase, shortening and narrowing of the colon, due to fibrosis, produce the typical "lead-pipe" appearance; the mucosal changes are those of atrophy. On the post-evacuation roentgenograms, there has become apparent retrograde extension of the longitudinal folds until the pattern looks much as if it had been traced around with bold strokes of a camel's-hair brush. In chronic forms of idiopathic ulcerative colitis, carcinoma may be a complicating factor and may cause the patient's death.

In the roentgenologic differential diagnosis. ulcerations due to typhoid fever, bacillary dysentery, tuberculosis, amebiasis, diffuse lymphogranuloma, and post-irradiation proctosigmoiditis must be considered. In certain instances, any of these conditions may be indistinguishable roentgenologically from ulcerative colitis. The diagnosis may be proved clinically by recovery of the inciting organism from the stool or, as in the case of tuberculosis and amebiasis, by earlier localization of the disease process in the right colon near the ileocecal valve. Occasionally either of the latter diseases may spread to involve the entire colon, and amebiasis is more prone to produce granulomatous masses. The history may disclose previous radiation therapy and so settle the question of proctosigmoiditis from that cause.

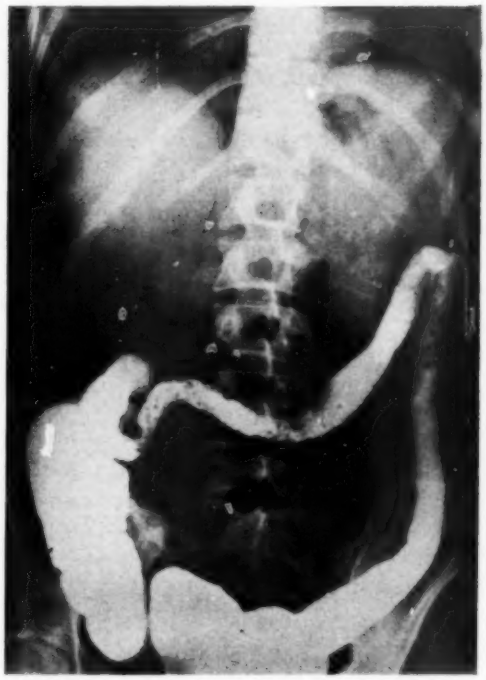


Fig. 8. Case of D. L., a 22-year-old girl with ulcerative colitis of two years duration.

Roentgen examination: An advanced process is evident, with multiple so-called pseudo-polypi, which histologic examination showed to be made up of islands of mucosa.

DISCUSSION

Although the diagnosis of ulcerative colitis frequently will be made by sigmoidoscopy, the roentgen detection of the early phases and of the extent of the disease will be of value. This is particularly true in that group of cases in which the ulcerative process is beyond the reach of the sigmoidoscope. In the patients studied, although the clinical progress did not closely correspond with the radiologic progress of the disease, there was a definite sequence, more or less generally followed, on serial roentgenograms in any one case. In many of the patients with signs and symptoms of idiopathic ulcerative colitis, the first barium enema study was reported as negative; with progression of the disease subsequent enemas showed unmistakable evidence of it, such as well developed ulcerations and fibrosis. Many of the patients came to surgery. When the diagnosis had been proved, a review of the first roentgenograms made it evident that the early changes described above, edema of the mucosa and minute erosions, were actually visible but had previously not been recognized.

SUMMARY AND CONCLUSIONS

In an attempt to determine the earliest roentgenologic signs of idiopathic ulcerative colitis, a review was made of the roentgenograms (many of them serial studies) taken in a group of 160 patients in whom the disease was known to be present clinically and sigmoidoscopically. As a result of this investigation, two signs have been found which, when combined, appear to be diagnostic of the early stages of the disease: (1) thickening of the mucosa, suggested by a change in the normal irregular crinkling of the mucosal pattern, and (2) scattered to multiple tiny serrations along the edge of the bowel.

The technical factors necessary for the demonstration of these early signs are (1) a well cleansed large bowel, and (2) roentgenograms of good quality taken at a speed fast enough to offset intra-abdominal motion and including one depicting a full, but not over-distended, colon.

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SUMARIO

Alteraciones Roentgenológicas Tempranas en la Colitis Ulcerada Idiopática

Tratando de determinar los primeros signos radiológicos presentes en la colitis ulcerada idiopática, repasáronse las radiografías (muchas de ellas seriadas) tomadas en un grupo de 160 enfermos en los que se conocía, por los signos clínicos y sigmoidoscópicos, la presencia de la enfermedad. Como resultado de la investigación, se han descubierto dos signos que, unidos, parecen diacríticos de las primeras etapas de la dolencia: (*1*) espesamiento de la mucosa, indicado por una alteración del arrugamiento irregular normal de la misma, y (*2*) presencia de pequeñas crenaciones, ya esparcidas o múltiples, a lo largo del borde intestinal.

Los factores técnicos necesarios para la observación de esos signos precoces son: (*1*) un intestino grueso bien limpio, y (*2*) radiografías de buena calidad tomadas con suficiente velocidad para contrarrestar el movimiento intraabdominal y comprendiendo una que reproduzca un colon lleno, pero no hiperdistendido.

The Osseous Lesions of Sarcoidosis[1]

JOHN F. HOLT, M.D., and WM. I. OWENS, M.D.

Ann Arbor, Mich.

IN THE FIFTY YEARS which have passed since Caesar Boeck (1) first described an apparently rare dermatologic condition which he chose to call "multiple benign sarkoid of the skin," this disease has come to be recognized as a generalized systemic disorder of interest and importance not only to dermatologists but to physicians in virtually all branches of medical practice. On occasion sarcoid lesions apparently confined to the skin are encountered, but the consistency with which deep-seated sarcoidosis occurs with or without skin alterations warrants thorough investigation of all organ-systems of patients in whom the disease is suspected.

The evolution of sarcoidosis as we now recognize it has been carefully documented by many writers, notably Hunter (2) and Longcope and Pierson (3). Their accounts of Hutchinson's "Mortimer's malady," Besnier's lupus pernio, Boeck's multiple benign sarcoid, Heerfordt's uveoparotid fever, Schaumann's lymphogranuloma benignum, Jüngling's osteitis tuberculosa multiplex cystica, and certain instances of the Mikulicz syndrome, and how all these apparently specific diseases were gradually recognized as different manifestations of a single clinicopathologic entity constitute one of the most fascinating chapters in the history of medicine. Nor has the chapter yet ended, for not only do each few years bring reports of sarcoidosis involving portions of the body in which it has not hitherto been described and new tests for the determination of its presence (4, 5), but the etiology of the condition never has been satisfactorily established.

Schaumann (6, 7), who made the first real attempt to correlate the various clinical and pathological manifestations of sarcoidosis, insists that the disease is primarily one of the lymphohematopoietic system, with or without involvement of the skin, and that the reporting of lesions in other portions of the body represents a failure to distinguish "what is essential and what is accidental." Like Besnier (8), Boeck (1), and Jüngling (9), as well as the majority of modern authorities, Schaumann has consistently maintained that sarcoidosis is a peculiar manifestation of tuberculosis. One can find considerable support for this theory in the contributions of various laboratory research workers. For example, Jadassohn (10) has produced sarcoid-like lesions in the skin of rats by injection of tubercle bacilli, and Florence Sabin (11) and her co-workers have obtained non-caseating "hard" tubercles typical of sarcoid by injecting only the lipoid fraction of tubercle bacilli into laboratory animals. On the other hand, it has been found that sarcoid-like lesions can be produced locally by the injection of other organisms (12) as well as by numerous inert substances such as grass (12) and silica (13). Gardner (14) showed that silica dioxide, injected intravenously, produced lesions in the liver, lymph nodes, and bones, indistinguishable from non-caseating tuberculosis; when the silica dioxide was inhaled, similar lesions occurred in the lungs. These findings, plus consistent failure to demonstrate viable tubercle bacilli in sarcoid lesions, have led some authorities to suggest that sarcoidosis is a disease of diverse etiology. Still others believe that it is due to an unrecognized bacillus, fungus, or filtrable virus. For additional information regarding the etiology, as well as the interesting immunologic aspects of sarcoidosis, the reader is referred

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[1] From the Department of Roentgenology, University Hospital, University of Michigan, Ann Arbor. Presented at the Thirty-fourth Annual Meeting of the Radiological Society of North America, San Francisco, Calif., Dec. 5-10, 1948.

to the articles of Michelson (15), Leider (16), and Jordon and Osborne (17).

CLINICAL FINDINGS

It is not within the province of this paper to discuss in detail the various clinical manifestations of sarcoidosis and the different organs which may be involved. A review of the voluminous literature on the subject indicates that sarcoid lesions have been reported in virtually every portion of the body except the hair and nails. Thus one finds an almost countless variety of clinical forms, with variable transition from one form to another, not only in different patients but at different times in the same individual. Longcope (18) has summarized the clinical manifestations of sarcoidosis exceedingly well, Harrell's (19) analysis of the laboratory findings is noteworthy, and Reisner (20) has contributed an exhaustive description of lesions in the various organs involved.

Among the manifestations of sarcoidosis which particularly interest the roentgenologist are the commonly encountered intrathoracic lesions which have been reviewed recently by Garland (21), the less common but relatively important lesions of the skeletal system, and the rarely reported lesions of the heart, the stomach, the intestinal tract, and the brain. It is with the osseous lesions that this presentation is primarily concerned.

HISTORICAL NOTE ABOUT OSSEOUS LESIONS

Probably the first description of the bone lesions of sarcoidosis was made by Kienböck (22) in 1902, approximately three years after Boeck's description of the skin and lymph node manifestations. Kienböck did not recognize the true significance of his findings, however, and included his patient in a series of cases of syphilis. Credit for correlating the skin and bone lesions belongs to Kreibich (23) who in 1904 described a patient with lupus pernio and destructive lesions in the phalanges. Hunter calls attention to the fact that in 1907 Remijnse (24), apparently in ignorance of Kreibich's paper, reported a case of "dactylitis syphilitica" associated with generalized lymphadenopathy in a patient who showed no other evidence of syphilis. Fortunately Remijnse reproduced excellent roentgenograms with his article, and in retrospect there is little doubt that the changes seen are those of sarcoidosis. Rieder (25), in 1910, again described the combination of lupus pernio and cyst-like lesions in the phalanges of two patients, and finally, in 1919, both Schaumann (26) and Jüngling (9) established histologic proof that the bony defects in similar cases of their own were due to a granulomatous process identical microscopically to the changes described by Boeck. Jüngling identified the osseous lesions as "osteitis tuberculosa multiplex cystica," in view of the suspected tuberculous etiology. In a second paper, published in 1928 (27), he changed the "cystica" to "cystoides," since histologic studies had shown that almost without exception the defects in bone were filled with granulomatous or fibrous tissue, and as such were not true cysts. In his second paper, Jüngling also reviewed 46 cases of "osteitis tuberculosa multiplex cystica" which had appeared in the literature up to that time, added nine examples of his own, and set forth in detail criteria for the roentgen diagnosis of the lesions, to which one can add very little indeed. His contribution stands as a classic in its field.

Probably the first recorded example of roentgenographically demonstrable bone lesions occurring in conjunction with Boeck's sarcoid in this country was reported by Finnerud (28) in 1921. Reproductions of the roentgenograms were not included in his report.

Doub and Menagh (29) introduced the subject of sarcoidosis of bone to the American radiologic literature in 1929, when they reported two cases showing typical lesions in the phalanges of the hands. Kirklin and Morton (30) added some pertinent roentgenologic observations in 1931 when they described six patients, three of whom had osseous lesions. Most of the numerous articles on sarcoidosis which have

appeared since that time have dealt largely with the more common pulmonary and mediastinal aspects of the disease.

LOCATION OF OSSEOUS LESIONS

For some reason, as yet unexplained, sarcoidosis has a predilection for the small bones of the hands and feet. The middle and distal phalanges are by far the most common sites for these granulomatous lesions, with the proximal phalanges, metacarpals, and metatarsals being involved occasionally, and other bones harboring the lesions rarely. Sarcoid foci have been reported in practically every bone in the body but only in the hands and feet are the lesions of practical diagnostic value. Although for some time we have felt that the bones of the feet are apt to be involved more commonly and more extensively than those of the hands, very little support for this opinion can be found elsewhere. This may be due in part to the fact that in most instances of suspected sarcoidosis roentgenograms of the feet are not requested routinely, the physician being content to limit his skeletal survey to the hands. It is our opinion that both hands and both feet should be filmed routinely and periodically if full advantage is to be taken of this valuable diagnostic aid.

Detail roentgenograms of the nasal bones should be made as part of any skeletal survey in patients who present dermatologic manifestations of sarcoid over the bridge of the nose, a rather common site for these lesions. Direct hypodermic extension of the sarcoid lesions not infrequently produces painless, non-tender destruction of the nasal bones.

INCIDENCE OF OSSEOUS LESIONS

It is difficult, if not impossible, to determine the exact number of reported instances of sarcoidosis with manifest bone involvement. After reviewing more than 100 case reports of such lesions, it became obvious that adequate proof of the diagnosis of sarcoidosis was lacking in some cases, whereas others were examples of definite caseating tuberculosis.

Of more practical importance is a determination of the true incidence of osseous lesions in a large series of patients with well established generalized sarcoidosis. Many groups of patients with sarcoidosis have already been reported, especially during the past few years, but there has been rather wide divergence of opinion as to the frequency with which bone sarcoid occurs; incidence figures as reported in series of ten or more patients have varied from zero in at least two instances (31, 32) to as high as 43 per cent (33). In general, bone lesions appear to be more common in European countries than they are in this country even among the Negro population, in which the presence of skeletal sarcoid is relatively great.

In an attempt to arrive at some more definite conclusion as to the incidence of osseous sarcoidosis, we reviewed the records of all the patients who had a diagnosis of sarcoidosis entered on their University of Michigan Hospital charts between July 1, 1935, and July 1, 1948. A total of 104 patients was found, 37 of whom had the clinical picture of generalized sarcoidosis, histologic confirmation of the diagnosis, and satisfactory roentgen examination of the hands and feet. Of this group, 8 (21.6 per cent) had definite bone lesions and 5 others had questionable lesions in the form of generalized osteoporosis, which some authorities believe represents a significant finding in this disease. If one adds to the 37 proved cases, the 28 additional patients who had convincing evidence of generalized sarcoidosis and roentgenograms of the extremities but no pathologic proof, 3 other instances of definite bone involvement and 6 patients with questionable osseous lesions must be added to the total. Considering this entire group of 65 patients, one finds the incidence of definite osseous involvement in this series of cases to be 16.9 per cent. It should be emphasized that this figure is not being presented as the true incidence of bone lesions in sarcoidosis. It merely represents an approximate incidence figure derived from an analysis of a fairly large

group of well studied patients in whom a definite search for osseous abnormalities was made, in many instances on multiple occasions. Since the group of patients with questionable lesions showed only nondescript porotic changes, they were not given serious consideration in the analysis.

Twenty-seven patients who did not have roentgenograms of the hands and feet at any time and 12 additional patients who in retrospect did not have sufficient clinical or laboratory evidence of sarcoidosis to warrant such a diagnosis were of necessity omitted from this survey.

If one combines the larger series of cases of sarcoidosis reported in this country in which the incidence of bone lesions was stated (34, 35, 19, 36, 31, 20, 37, 38, 21, 39, 32), he finds a total of 279 patients of whom 42, or 15.05 per cent, had definite osseous foci. Admitting the statistical shortcomings of such an approach without specific inquiry as to the thoroughness of individual authors' analyses, the similarity of this group incidence figure to our own is rather striking.

Whatever the true incidence of osseous lesions in sarcoidosis may be, when one considers the extreme diagnostic value of definite positive roentgen findings in the bones, the importance of routinely surveying the hands and feet roentgenographically in suspected instances of the disease is immediately apparent. On the other hand, roentgenologists should make it very clear to referring physicians that failure to find characteristic sarcoid defects in bone does not rule out the diagnosis.

King (36) and others have implied that the importance of obtaining roentgenograms of the hands and feet routinely has been over-emphasized; that the presence of osseous lesions is almost always forecast by adjacent soft-tissue swelling. Whereas this is true in most instances, one cannot rely upon it entirely. For example, not one of the six patients with bone lesions reported by McCort *et al.* (37) had local signs or symptoms of such abnormalities. Furthermore, one of our patients showed pronounced fusiform swelling of a finger without any roentgenographic evidence of an underlying osseous defect.

In most series of patients with sarcoidosis, the incidence of bone lesions appears to be directly proportional to the incidence of skin lesions. Interestingly enough, this appears to be almost as true when the skin lesions are located on the face or back as it is when they are found on the fingers or toes.

There is no appreciable difference in the age and sex of patients with the osseous lesions of sarcoidosis from those who have manifestations of the disease in other organs.

PATHOLOGY OF OSSEOUS LESIONS

The histologic findings in sarcoidosis of bone are precisely the same as they are in other portions of the body. Thus one finds a granulomatous reaction consisting of the basic "hard" or "naked" tubercle composed of epithelioid cells, well formed giant cells and occasional lymphocytes (Fig. 1). The absence of significant caseation necrosis affords the main point of differentiation from tuberculosis. Nickerson (40) states that the giant cells in sarcoid are larger than those in tuberculosis, there being in each cell as many as 25 or 30 nuclei evenly distributed instead of elliptically arranged as in tuberculosis. This point is controversial, however, as is the diagnostic significance of the asteroid bodies and the laminated inclusions which Schaumann (41) observed in many of his cases of sarcoidosis and to which he attached considerable importance.

That histologic diagnosis in sarcoidosis often leaves much to be desired is emphasized in a recent article by Michelson (15), who states that "neither the type of cells, the arrangement, the presence or absence of necrosis, nor the discovery of special bodies such as Schaumann has found in his explorations makes it possible for a pathologist to say 'This is sarcoidosis and cannot be anything else.' Microscopic study of excised lesions permits a diagnosis of sarcoid structure, but the

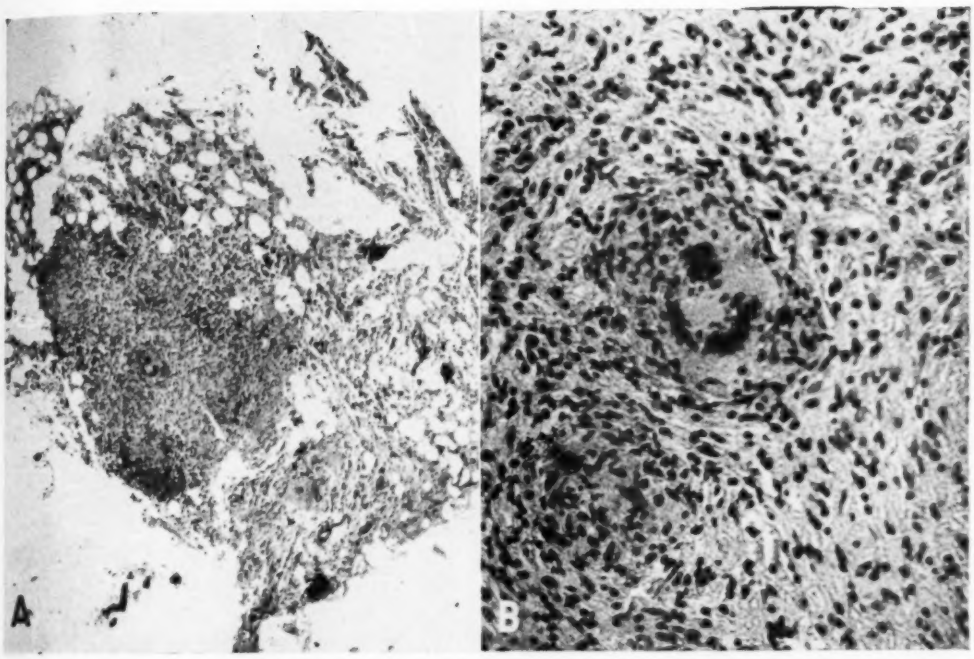

Fig. 1. Typical non-caseating tubercle removed from metatarsal of patient with extensive sarcoidosis (Case I). A. Low-power photomicrograph. B. High-power photomicrograph showing huge giant cell and epithelioid cells.

diagnosis of sarcoidosis must be based on the sum total of the evidence obtained in each case."

In this light, the immense diagnostic importance of positive roentgen findings comes into its true perspective.

ROENTGENOLOGIC MANIFESTATIONS

It is paradoxical, yet fortunate, that the osseous lesions in sarcoidosis have such a peculiar affinity for the small bones of the hands and feet; paradoxical in the sense that one might well expect more widespread involvement of the skeleton in a generalized systemic disease; fortunate because the precise localization of the lesions furnishes the physician with easily obtainable, specific diagnostic information in a bizarre disease where characteristic clinical findings in most instances are conspicuously lacking. Positive roentgenologic bone findings are especially valuable when the presence of deep-seated sarcoidosis is not reflected by cutaneous lesions or when an involved peripheral lymph node is not available for biopsy.

Most authorities agree that the roentgenologic bony manifestations of sarcoidosis, when present, are practically pathognomonic of the disease and that, once familiar with the typical appearance of these lesions, the roentgenologist should have no difficulty in recognizing them. Schaumann (42) has made extensive histologic studies of osseous sarcoid lesions particularly emphasizing the relationship of histologic observations to roentgenologic manifestations. Such correlation allows for a much clearer and less superficial understanding of the problem.

It has been found that the medullary cavity is the primary seat of the epithelioid tubercles of sarcoidosis and frequently these medullary lesions are much more extensive than radiologic examination will indicate. In fact, the entire skeletal marrow may be involved without producing recognizable destruction of adjacent corti-

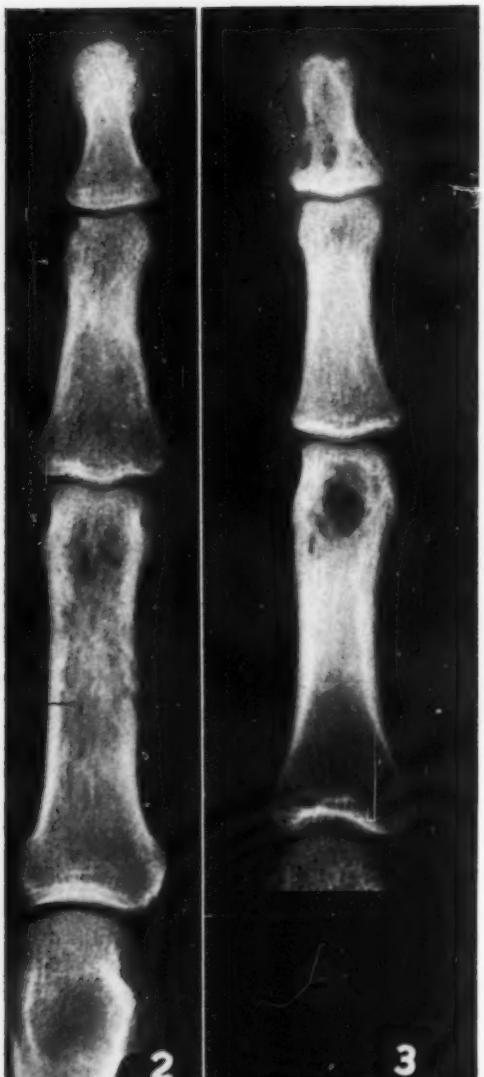

Fig. 2. Mottled rarefaction in a proximal phalanx representing an early manifestation of sarcoid invasion of bone.

Fig. 3. Cyst-like vacuole in distal end of proximal phalanx of another patient with sarcoidosis. Such "punched-out" lesions usually result from coalescence of the smaller destructive foci illustrated in Fig. 2. The distal phalanx also is involved.

cal or cancellous bone, thus yielding completely negative roentgenologic findings. That such generalized medullary infiltration is uncommon is confirmed by the disappointing results obtained in the use of

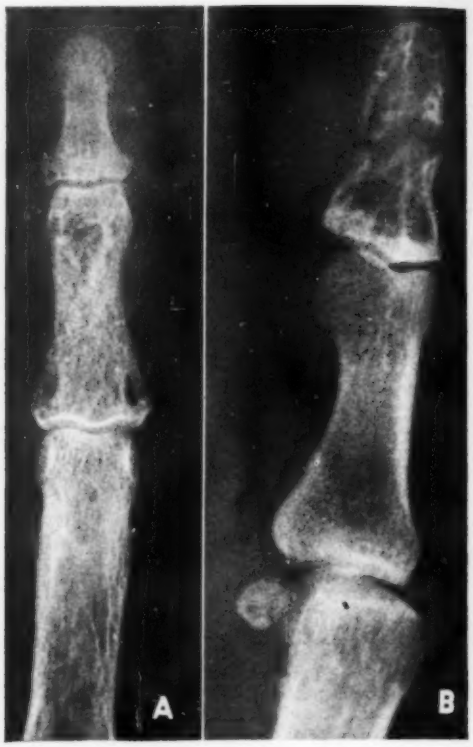

Fig. 4. Examples of the classical reticular pattern of bone destruction in fingers of two different patients with sarcoidosis. Note the interesting lace-like appearance in B, along with the "pathologic" fracture.

sternal puncture as a diagnostic procedure in sarcoidosis (43).

Usually, if sarcoid is present in the marrow, secondary changes in adjacent bone occur in one of several patterns. If progress of the granulomatous process is slow and if lacunar resorption takes place in a fairly uniform manner over a relatively large area (*e.g.*, an entire phalanx), diffuse enlargement of the lacunae occurs, resulting in mottled rarefaction of the bone. This can be recognized roentgenographically in its early stages as a *stippled pattern*, with tiny dots of diminished density projected against a background of bone or normal or near normal density (Fig. 2).

There is a definite tendency for the above mentioned rarefaction to develop more intensely at certain points, such as the

distal ends of the proximal and middle phalanges and the proximal ends of the distal phalanges. Here the lacunae not only enlarge but also coalesce to produce localized cavities of varying sizes and shapes. These are the very popular and considerably overworked "*punched-out*" *lesions* of the roentgenologist (Fig. 3). These cyst-like areas of bone destruction are usually round, but at times may be ovoid, pear-shaped, or heart-shaped. They may be solitary or multiple, depending upon the intensity of the granulomatous process in any given portion of the medullary bone. Not infrequently several smaller "cysts" coalesce to form one large lesion. These lesions are sharply circumscribed and one of the most striking features about them is the completely normal appearance of bone immediately adjacent to them.

At times lacunar absorption due to rapidly progressing sarcoid extending outward in all directions completely eradicates the trabeculae of cancellous bone, eventually thinning and expanding the cortex, simulating the classical *spina ventosa* of caseating tuberculosis.

In addition to the above mentioned changes which develop secondary to medullary foci, perivascular infiltration of the haversian canals may occur, with resultant thinning of the cortex and destruction of the finer trabeculae. In the very early stages of this pathologic process, one sees on the roentgenogram apparent localized osteoporosis, which is entirely non-specific and hence not characteristic. Later this non-specific deossification is supplanted by a *reticular pattern* of bone destruction which appears to be the most common and most specific single roentgen manifestation of osseous sarcoid (Fig. 4). This reticular pattern has been described by the terms "lace-work," "grille-work," or "lattice-work" and, at times, any of these descriptive phrases applies. The important point to remember is that, once recognized, these findings in sarcoidosis are seldom mistaken for anything else.

Obviously both the medullary and perivascular lesions of sarcoid may occur in the same bone and, in such instances, the roentgen appearance has varying combinations of the features of both. Hence the roentgenologist must be familiar with the numerous transitional forms as well as the more well defined ones. Perhaps the most conclusively diagnostic combination of signs in any one bone is the diffuse reticular pattern plus one or more cyst-like areas located at or near a nutrient foramen (Fig. 5).

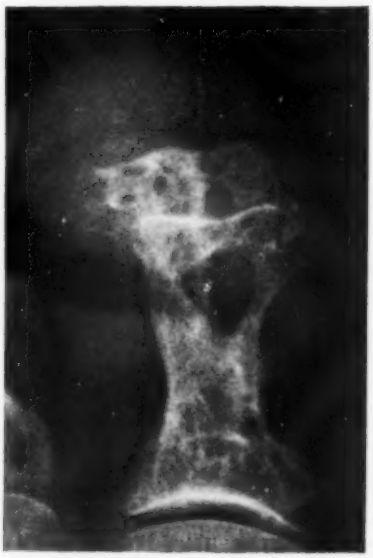

Fig. 5. Combination of reticular pattern of bone destruction, cyst-like lesion, and mutilating deformity of great toe in patient with advanced sarcoidosis.

Any of the bone lesions just described may progress to such an extent that "pathologic" fractures occur or complete destruction of one or more phalanges takes place. These extreme lesions are apt to produce severe mutilating deformities, for which amputation of the involved digit is necessary (Figs. 5 and 6). Fleischner (44) has described and illustrated these mutilations particularly well. He suggests that they are possibly due in part to trophic influences brought about by the infiltration of sarcoid granulomas into surrounding soft tissues. As a result, there is strangulation of the bone from without as well as destruction from within.

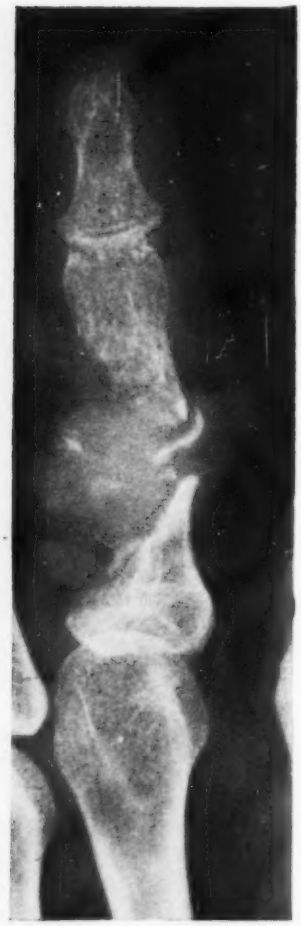

Fig. 6. Extensive destruction of proximal and middle phalanges, with remarkable preservation of articular cartilage between them. The total absence of periosteal new bone formation is typical of sarcoidosis.

On the other hand, any of the lesions, but particularly the diffuse ones, may undergo partial or complete spontaneous regression. The latter is a rare occurrence, some residual anatomic alteration persisting as a permanent deformity in most instances. The cyst-like vacuole in the end of the bone appears to be the most chronic lesion of all. One finds in the literature several illustrations of diffuse lace-like lesions of the phalanges apparently resolving themselves into these vacuoles or so-called pseudo-cysts, which persist for years. Histologic investigation of such cases has shown that the lesion actually has healed but complete fibrous replacement of the epithelioid granuloma accounts for the persistent scar.

Two additional very important aspects of sarcoid lesions in bone are the relative inviolability of the periosteum and the almost total absence of joint involvement. Schaumann found in some of his histologic specimens fibers of the periosteum enveloping epithelioid foci which communicated with the medullary canal in some instances and intermingled with extra-osseous foci in others, but there was little or no evidence of accentuated subperiosteal new bone formation such as one encounters in most inflammatory lesions. Roentgenologically, the absence of periosteal thickening in bone sarcoid is one of the most valuable of all diagnostic signs. In fact, so reliable is it that when evidence of periostitis is present one should seriously question the diagnosis of sarcoidosis. The same is true of bone sequestra, which with their accompanying draining sinuses are almost never seen in this disease.

The absence of joint involvement is equally striking, and patients may maintain normal or nearly normal articular function even when severe mutilating deformities are present. This feature, in addition to the fact that bone lesions in sarcoidosis usually are painless, undoubtedly accounts for the conspicuous absence of disuse osteoporosis in the afflicted extremities. Two of our patients had almost total destruction of adjoining phalanges, but in each case sufficient cortical bone adjacent to the intervening articular cartilages remained to indicate that the cartilage was intact (Figs. 6 and 8C). Occasional examples of apparent polyarticular sarcoidosis have been described in children but, while such cases (45, 46) are of great interest, they must be regarded as exceptional rarities.

It has been stated that when the osseous lesions of sarcoidosis occur in children, the epiphyses are especially apt to be involved. Having observed such bone lesions in no patient under the age of nineteen years,

we are not in a position to confirm or deny this statement.

DIFFERENTIAL DIAGNOSIS

Although written descriptions of the osseous manifestations of sarcoidosis frequently leave one with the impression that these lesions may be confused with other abnormalities, visual familiarity with the various roentgenologic appearances of osseous sarcoid should preclude this possibility in the majority of instances. It is true that *hyperparathyroidism* and so-called *polyostotic fibrous dysplasia* may produce alterations in the phalanges which may simulate the advanced diffuse type of lesion in sarcoidosis, but when the digits are involved in these fibrocystic diseases, the other long bones of the skeletal system are even more extensively involved. *Multiple enchondromata* tend to expand the cortices of the involved bones to a much more pronounced degree than do the lesions of sarcoidosis. We have seen one patient with a *xanthofibroma* invading a phalanx in which the pattern of bone destruction was of the "lattice-work" variety.

The intramedullary tophi of gout and the localized, smoothly rounded, sharply circumscribed cyst-like lesions so often seen in the ends of the phalanges in *rheumatoid arthritis* and *osteoarthritis* may closely simulate the chronic, "punched-out" lesions of sarcoidosis, but if it is remembered that sarcoid almost never involves the joints, no diagnostic confusion should result. Incidentally, swelling and mild pain of the right great toe constituted the initial complaints of one of our patients with generalized sarcoidosis (Case 4). In view of these findings, she was referred to the hospital with a provisional diagnosis of gout.

From the roentgenologist's point of view, the danger of mistaking the osseous lesions of sarcoidosis for any one of the entities mentioned thus far under differential diagnosis is largely theoretical. With few exceptions the only practical difficulty in this regard lies in distinguishing the few rare abnormalities which, like sarcoidosis, may produce destructive lesions in the phalanges in conjunction with either unexplained pulmonary disease, sarcoid-like skin lesions, or a combination of both. *Systemic fungus disease* may present such findings. For example, we have observed destructive lesions in the hands and feet of two patients with proved *pulmonary sporotrichosis* and *blastomycosis*, respectively. In each instance, there was some evidence of periosteal new bone formation at the site of the destructive foci and this finding in itself was regarded as overwhelming evidence against a diagnosis of sarcoidosis. *Coccidioidomycosis* and *torulosis* might also produce a similar combination of intrathoracic and osseous abnormalities.

Although pulmonary lesions in *leprosy* occur infrequently, if ever, the skin lesions of leprosy and sarcoidosis may be quite similar, and several writers (47, 48) have illustrated osseous changes which closely simulate the bony mutilations of advanced sarcoidosis. We have in our teaching collection of interesting roentgenograms a film which shows cyst-like lesions in the phalanges of a native Filipino man who had typical skin lesions of *yaws*.

Tuberculous dactylitis of the so-called *spina ventosa* variety usually occurs in children and tends to involve the metacarpals and metatarsals more often than the phalanges. Roentgenographically, a bone so involved appears to be distended by air, and there frequently is associated periosteal thickening. Only in very rare instances is this lesion difficult to identify.

One finds in the medical literature examples of widespread tuberculous bone involvement in children reported at infrequent intervals and referred to under such names as "cystic tuberculosis of bone" (49, 50), "cystic tuberculous osteitis (51), "tuberculosis of the shafts of long bones" (52), and "osteitis tuberculosa multiplex cystica" (53–55). It is particularly unfortunate that Jüngling's term was used to describe the lesions in some of these patients, because, as Ellis (51) has pointed out, all of Jüngling's cases were examples

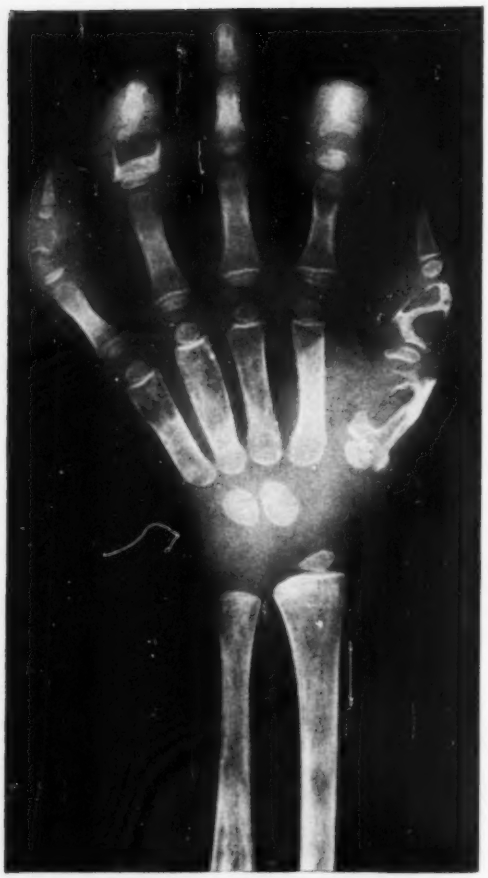

Fig. 7. Left hand of 3-year-old Negro with proved tuberculous osteitis involving skull, ribs, and many tubular bones. The mutilating destructive foci in the metacarpals and phalanges are strikingly similar to those seen in certain instances of sarcoidosis. Other bones, however, showed extensive periosteal new bone formation. Patient had numerous draining sinuses, and a positive tuberculin reaction. At autopsy, caseation necrosis was found in the bone lesions and tubercle bacilli were cultured from caseous material removed from mesenteric lymph nodes. (Roentgenogram, courtesy of Dr. H. H. Brueckner, Canton, Ohio.)

of osteal sarcoid rather than frank osseous tuberculosis with its typical caseation necrosis, sinus formation, positive tuberculin reaction, and demonstrable acid-fast bacilli. Occasionally lesions of the hands and feet occurring in "cystic tuberculous osteitis" may simulate the mutilating changes seen in advanced sarcoidosis (Fig. 7), but the other manifestations of the disease, just enumerated, should simplify the differential diagnosis.

Finally, it should be emphasized that small, isolated, rounded zones of increased radiolucency frequently are encountered in roentgenograms of the hand bones of normal individuals and should not be mistaken for sarcoid lesions. These vacuoles, which are most often observed in the heads of the metacarpals, probably represent cartilaginous rests or insignificant foci of fibrous tissue replacement of bone resulting from some minor defect in normal ossification. Localized areas of increased density in the bones of the hands also should be disregarded in most instances, although Jüngling refers to sclerosis of bone as a rare manifestation of healing in osteal sarcoid. It is interesting, but probably entirely coincidental, that three of the patients in our group with generalized sarcoidosis showed sclerotic changes in the ends of the terminal phalanges of the hands.

ILLUSTRATIVE CASE REPORTS

CASE I: A. B., a 42-year-old white man, was first seen at University Hospital in 1928 and was followed over a period of nineteen years, until his death. The initial diagnosis was tuberculosis of the nose and tonsil (biopsy), and in 1934 additional diagnosis of tuberculosis of the skin, lymph nodes, larynx, and lungs was made. It is significant that, in retrospect, biopsy specimens show little evidence of caseation necrosis and tubercle bacilli were never recovered from any of the lesions.

In 1942, fusiform swelling of the fingers and toes appeared for the first time, and in 1943 the patient began to complain of cough, shortness of breath, and occasional bloody sputum. Roentgenograms of the chest showed extensive patchy and confluent areas of increased density in both lungs, the process having increased in extent since 1934. Films of the hands and feet showed widespread destructive lesions in many of the bones (Fig. 8A), thought to be typical of sarcoidosis. The patient also had areas of destruction in the nasal bone and maxilla due to direct extension of the disfiguring skin lesions of the face. Biopsy of tissue from the nasal vestibule, hard palate, face, hand, and toe showed epithelioid tubercles with very little caseation necrosis. The pathologic diagnosis was tuberculosis, but no acid-fast organisms were found.

After being discharged to a tuberculosis sanatorium for a second time, the patient returned again to University Hospital in 1947, at which time his numerous lesions appeared to have progressed (Fig. 8B). "Egg-shell" calcifications in the hilar

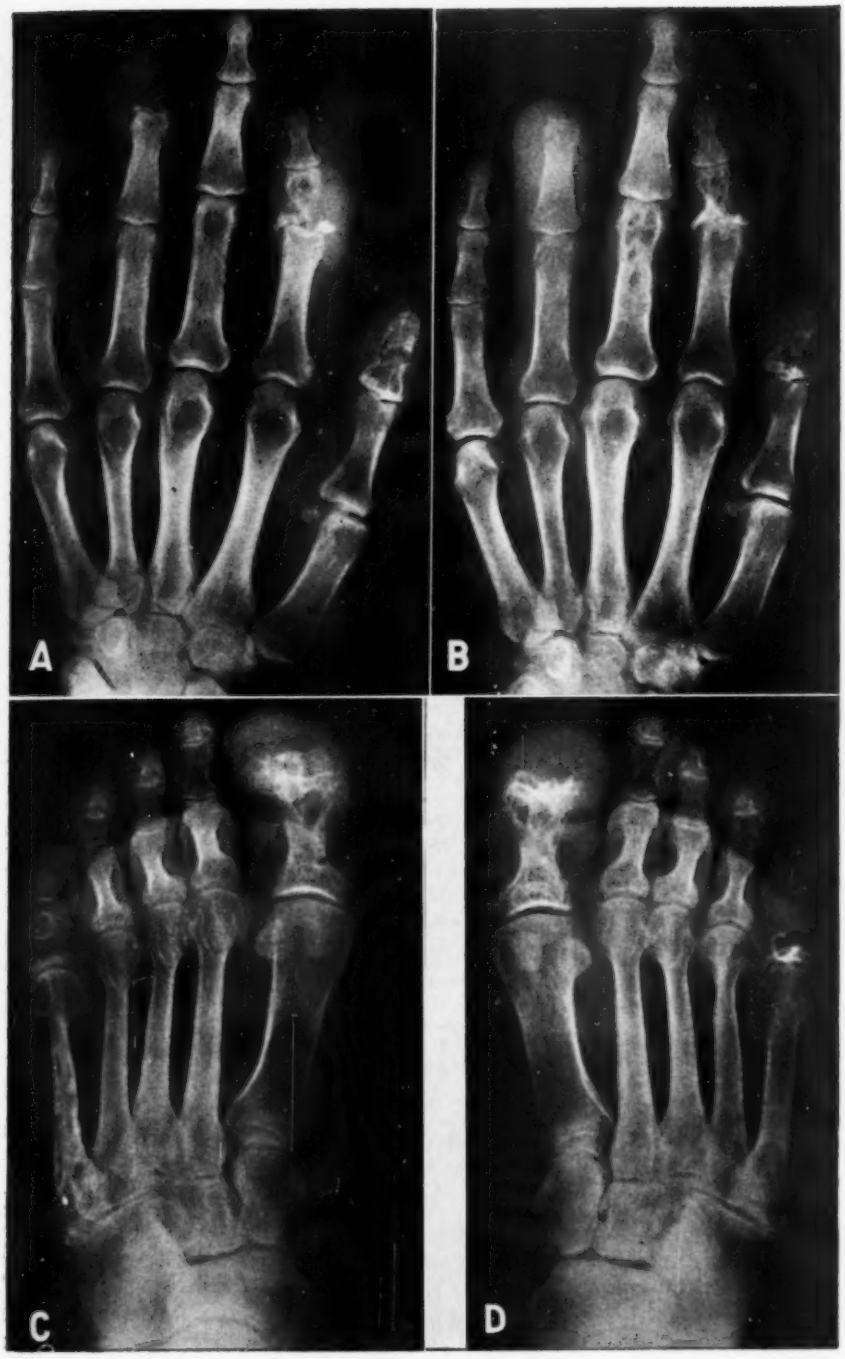

Fig. 8. Case I. A. Widespread destructive changes in left hand of patient with sarcoidosis of fifteen years duration. Similar lesions were present in the right hand and both feet (12–24–43). B. Increase in extent of bone destruction in left hand three and a half years later (4–1–47). C and D. Destructive foci in feet of same patient (4–1–47).

regions, of the type commonly associated with silicosis, had developed since 1943. Biopsies of the skin and the left fifth metatarsal showed "non-caseating epithelioid tubercles of the type seen in Boeck's sarcoid" (Fig. 1).

At no time could tubercle bacilli be demonstrated in the patient's sputum or in any of the multiple biopsy specimens.

Significant Laboratory Findings: Kahn negative; tuberculin 1:1,000 negative, 1:100 positive; serum calcium, 15.3 mg. per cent; phosphorus 4.8 mg. per cent; alkaline phosphatase 3.0 units (Bodansky); total serum proteins 9.2 per cent; albumin 3.8 per cent; globulin 5.4 per cent; urea clearance 24 per cent first hour, 36 per cent second hour; urea nitrogen 29.8 per cent; NPN 49.5 mg. per cent.

Course: The skin lesion improved on a modified Charpy regime (huge doses of Vitamin D_2) (56) but the general condition grew steadily worse and the patient died on June 11, 1947. Incidentally, all of the above laboratory findings were recorded before institution of vitamin D_2 therapy.

Autopsy Report: Anthracosilicosis of lungs and bronchial lymph nodes; ischemic cavitation in right lower lobe of lung; bronchiectasis; sarcoidosis of Boeck of skin, lungs, bronchi, larynx, lymph nodes, mucous membranes of hard palate, and bones of hands and feet; Schaumann bodies in lungs and lymph nodes; acute purulent exacerbation of chronic bronchitis; pulmonary edema and pneumonia; interstitial myocarditis (? sarcoidosis); fibrocalcareous mediastinal lymph nodes; calcific deposits in the renal tubules.

Comment: Roentgenograms of this patient's hands and feet (Fig. 8) demonstrate all of the main types of sarcoid bone lesions, along with a number of intermediate forms. It should be emphasized that the diffuse reticular or lace-like pattern of bone destruction rather than the localized "punched-out" type of lesion predominates. The mutilating deformities and soft-tissue swellings simulate the bone changes seen in some patients with leprosy.

Despite virtually complete destruction of the phalanges of each fifth toe, the interphalangeal spaces of these digits appear to be remarkably well preserved, presumably because the articular cartilages have remained intact.

The elevation of the serum calcium which occurs in some patients with sarcoidosis is not associated with a proportionate lowering of the inorganic phosphorus level such as one encounters in hyperparathyroidism, and there is no known correlation between these blood chemistry alterations and osseous lesions. The marked hypercalcemia in this patient probably is related to the autopsy findings of extensive calcification of the renal tubules. A scout film of the abdomen made before the patient's death failed to show evidence of microscopic calcification in the kidneys (see Case IV).

The coexistence of sarcoidosis and silicosis in the lungs is of interest in the light of Mallory's (57) recent observations on the pathology of so-called "idiopathic pulmonary fibrosis," as well as the experimental work of Gardner, to which reference already has been made.

CASE II: B. B., a 59-year-old colored woman with neurosyphilis, was first seen at University Hospital on April 7, 1943, when biopsy of one of several purplish, indurated skin lesions on her face showed "widespread infiltration of epithelioid tubercles." The diagnosis was considered to be either tuberculosis or sarcoidosis.

As the patient had some painless swelling of several fingers, roentgenograms of the hands were requested. These showed generalized osteoporosis, cyst-like areas of rarefaction, and a diffuse reticular pattern of bone destruction in several of the phalanges thought to be compatible with sarcoidosis (Fig. 9A). Chest films showed no evidence of disease and there was no obvious peripheral lymphadenopathy. The Department of Ophthalmology found chronic dacryocystitis and conjunctivitis of the left eye.

The superficial sarcoid lesions showed considerable resolution when the hands were re-examined roentgenographically on Nov. 15, 1946. Although signs of osseous destruction were still visible, the over-all appearance of the bones was one of considerable improvement. With involution of the sarcoid tissue, there was considerable narrowing of the "waists" of some of the phalanges. The few "pseudo-cysts" which had been seen previously persisted (Fig. 9B).

Comment: This is an example of unmistakable spontaneous regression of sarcoid bone lesions observed over a period of three years. The narrowing of the "waists" of some of the phalanges occurring as part of the healing process produced an appearance not unlike that seen in some patients with advanced hyperparathyroidism, but the generalized osteoporosis of that disease was lacking at the time of the second exam-

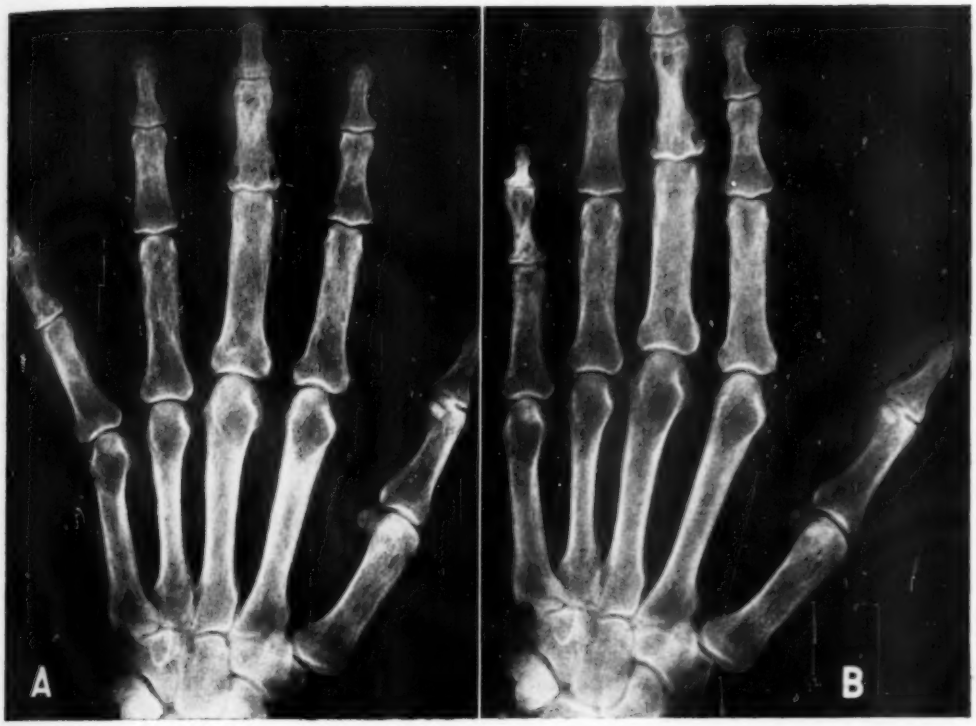

Fig. 9. Case II. A. Diffuse osteoporosis and reticular bone destruction in left hand of patient with sarcoidosis as seen on 8–10–43. The right hand showed similar abnormality. B. Appearance of left hand three years later (11–15–46). Definite partial regression of the bone lesions has occurred.

ination. Although diffuse roentgenologic porotic changes may imply widespread sarcoid infiltration of the marrow spaces, very little significance can be attached to this finding in the absence of more specific signs of bone involvement. This is especially true in the older age groups.

CASE III: G. B., a 35-year-old colored housewife with syphilis, came to University Hospital in July 1945, seeking treatment for a large, fungating, nontender lesion of the nose and a severe mutilating deformity of the right third finger, thought to be of syphilitic etiology. Roentgenograms of the hands were requested, and as there was some swelling of the dorsum of the right foot, films of the feet also were made, more or less as an afterthought. In the hand there was a purely lytic lesion which had destroyed most of the proximal and middle phalanges of the right third digit (Fig. 6), and in the feet a "lace-like" pattern of bone destruction was observed in the head of each first metatarsal bone (Fig. 10). On the basis of findings in the feet, a roentgenologic diagnosis of sarcoidosis was suggested and films of the chest were requested. These showed bilateral hilar adenopathy, and a survey of the long bones showed additional destructive lesions in the left fibula and right tibia.

A skin biopsy showed numerous epithelioid nodules with occasional areas of caseation. Although the pathologist felt that the biopsy findings were more compatible with tuberculosis, a diagnosis of sarcoidosis was made on the basis of the entire clinical picture.

Several courses of antisyphilitic therapy produced no demonstrable change in the patient's lesions, and she was started on a modified Charpy regime on May 9, 1947. This was interrupted temporarily while she delivered a normal infant following an uneventful pregnancy. The badly deformed right third finger was amputated, and sections showed a "granulomatous process with non-caseating tubercles."

The skin lesions improved markedly following the vitamin D_2 therapy, but the bone lesions remained unchanged.

Comment: This patient's roentgenograms illustrate the extent to which bone

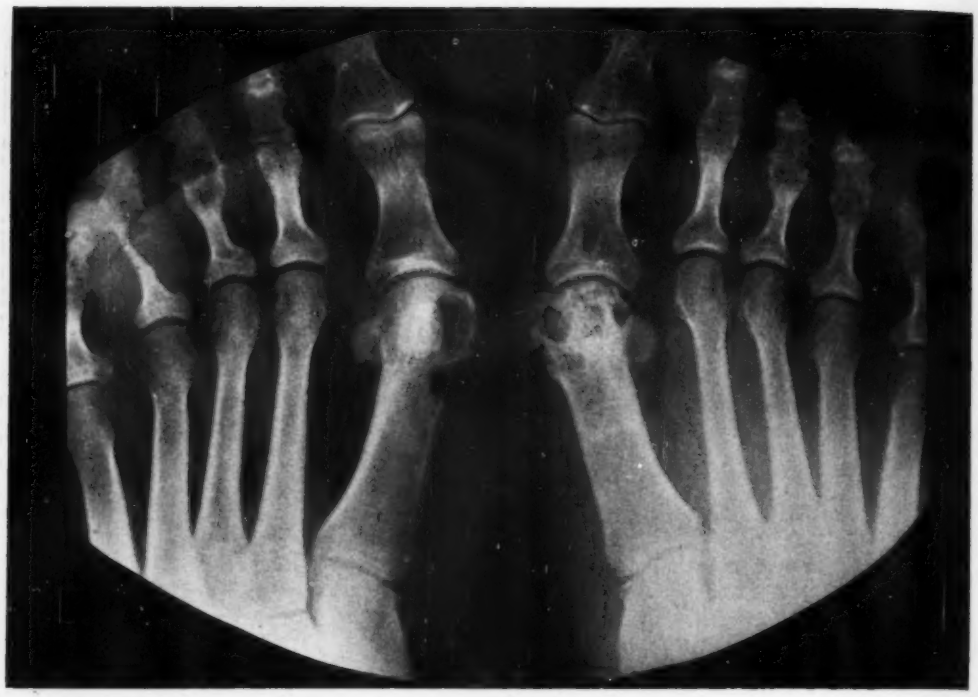

Fig. 10. Case III. Lace-like pattern of sarcoid bone involvement in each first metatarsal head is associated with larger rounded areas of rarefaction which might easily be mistaken for gouty tophi. Additional destructive foci are present in the phalanges of the third and fourth toes of the left foot.

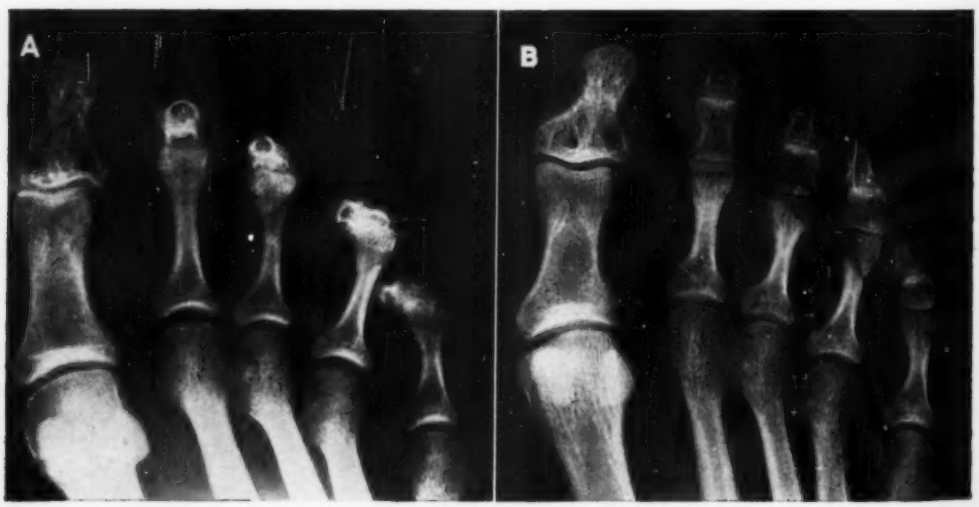

Fig. 11. Case IV. A. Sarcoid bone lesion confined to terminal phalanx of right great toe as seen on 5–18–44. The left foot and both hands were normal in appearance. B. Four years later (5–10–48) the right great toe is essentially unchanged. (Courtesy Dr. S. W. Donaldson, Ann Arbor, Mich.)

destruction in sarcoidosis sometimes may go, and indicate further the advisability of routinely surveying the feet. It was the characteristic reticular pattern of bone destruction in the metatarsals, and not the appearance of the mutilated finger, which prompted the roentgenologist first to suggest that the osseous component of the disease was sarcoidosis rather than syphilis.

The initial discrepancy in the clinical, roentgenologic and pathologic diagnoses emphasizes the necessity of correlating all of the findings before arriving at a final diagnosis in patients with sarcoidosis.

CASE IV: J. B., a 28-year-old white woman, had always been well until at the age of twenty-five years she awoke one morning with pain, swelling, and redness in the first joint of the left great toe. These attacks recurred repeatedly over a period of six months, and the patient was told by her physician that she had gout. She was placed on a low-purine diet and treated with colchicine and cinchophen. Although nausea developed during cinchophen therapy, the joint symptoms improved and during the year before she was first seen at University Hospital, May 18, 1943, the patient had only one slight attack of pain. During this same year a slight cough developed, which was productive of a small amount of sputum.

Physical examination showed only a few slightly enlarged lymph nodes in the cervical, supraclavicular axillary, and epitrochlear regions. Mediastinal adenopathy, as well as bilateral basilar infiltration, was seen on chest roentgenograms obtained on July 20, 1943, and a diagnosis of lymphoblastoma was suggested. On the basis of this suggestion, biopsy of lymph nodes in the left supraclavicular and left epitrochlear regions was done. These showed a widespread infiltration of non-caseating epithelioid nodules thought to represent "either Boeck's sarcoid or tuberculosis of relatively low virulence."

Roentgenograms of the hands and feet made on May 18, 1944, by Dr. S. W. Donaldson (St. Joseph Mercy Hospital, Ann Arbor, Mich.) showed typical changes of sarcoidosis peculiarly confined to the distal phalanx of the right great toe (Fig. 11A).

On Sept. 22, 1945, the patient gave birth to a normal male infant, by normal spontaneous delivery. On Oct. 13, 1948, she was again admitted to University Hospital with a history of many recurrent episodes of symptoms referable to the urinary tract since early in 1946. A severe anemia which had developed during this time had been corrected only by repeated blood transfusions. Physical examination showed minimal cervical adenopathy and marked enlargement of the liver and spleen.

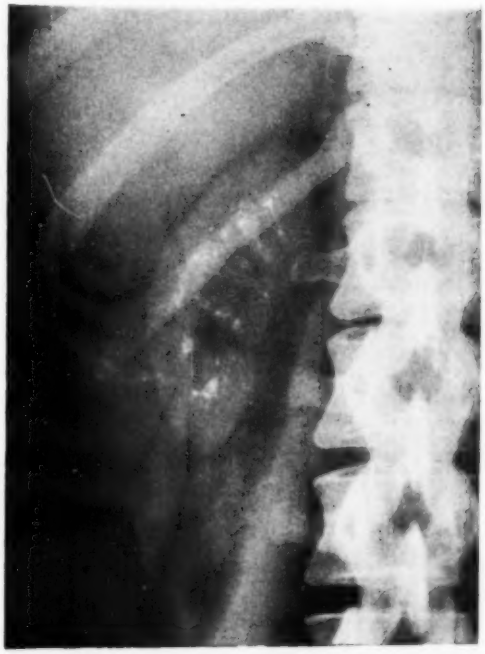

Fig. 12. Case IV. Diffuse calcification in right kidney with distribution in papillae similar to that seen in hyperparathryoidism. The left kidney had a similar appearance. Paradoxically, this patient did not have an elevated serum calcium level and did not receive vitamin D therapy.

Review of roentgenograms made elsewhere (May 10, 1948) indicated complete regression of the right paratracheal and bilateral hilar adenopathy. The destructive process in the right great toe was essentially unchanged (Fig. 11B), and no new lesions had appeared in either the hands or feet.

Laboratory Findings: Blood: Hb. 9.5 gm.; red cells 3,400,000; white cells 8,000. *Urine:* 1+ to 3+ albuminuria; inability to concentrate over 1.011; catheterized specimen loaded with white blood cells and cocci. *CO_2-combining power* 25 vol. per cent. *N.P.N.* 195 mg. per cent. *Urea clearance* 6 per cent at the end of the first and second hours. Urea nitrogen 139 mg. per cent; total serum proteins 10.1 gm. per cent; albumin 5.7 gm. per cent; globulin 4.4 gm. per cent; serum calcium 9.8 mg. per cent.

Excretory pyelograms obtained on Oct. 19, 1948, showed no visible excretion of opaque medium. The kidneys appeared to be contracted, and the cortex of each was abnormally roentgenopaque, suggesting the presence of widespread calcium deposits (nephrocalcinosis). Disseminated calcium deposits in the pyramids had assumed the pattern commonly seen in patients with hyperparathyroidism (Fig. 12).

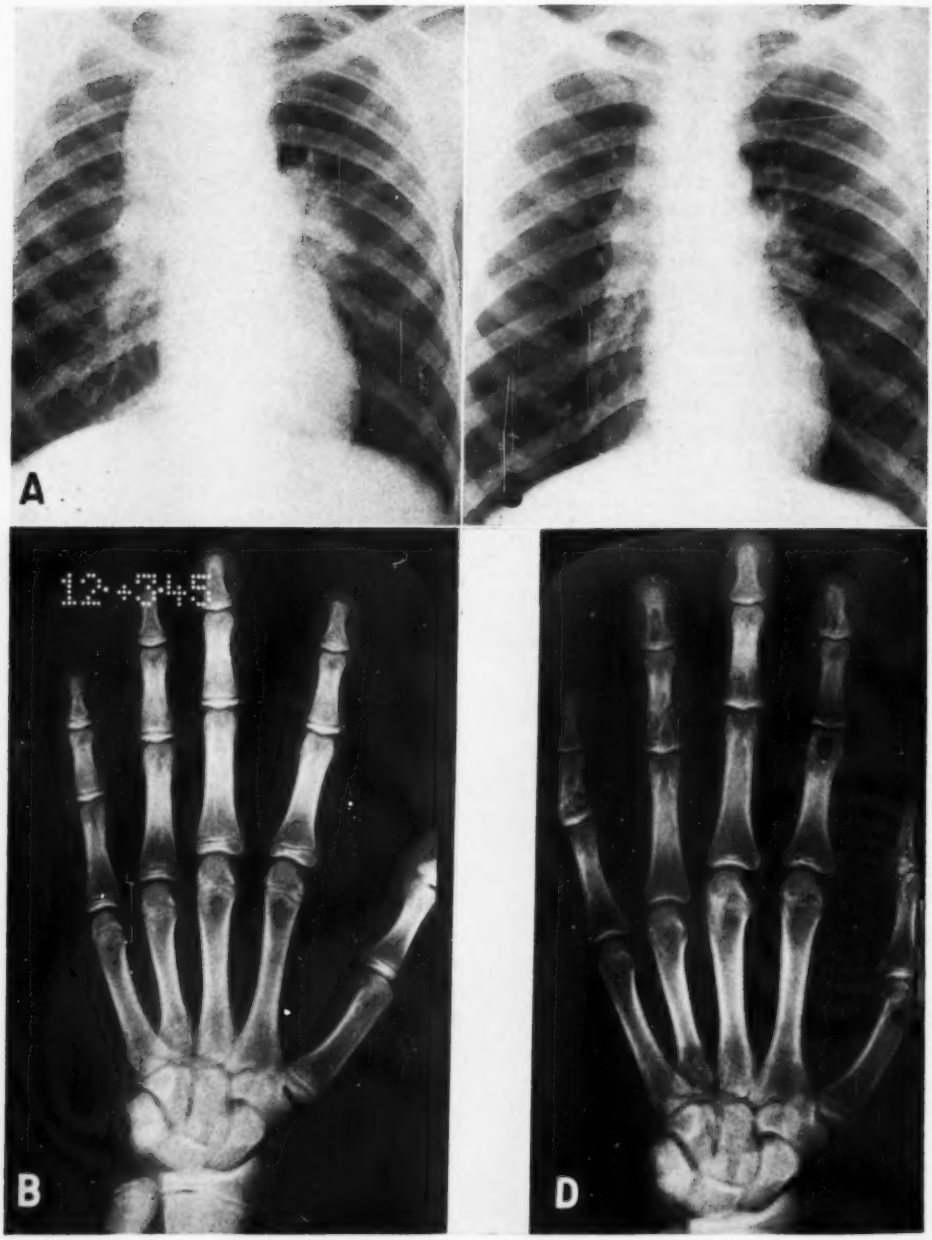

Fig. 13. Case V. A. Mediastinal adenopathy in 17-year-old Negro with proved sarcoidosis (11–12–45). B. Examination of hands (12–3–45) showed no destructive lesions. C. Pronounced regression of mediastinal adenopathy (4–1–47). D. Despite regression of chest lesions, multiple destructive foci are now seen in bones of left hand (4–1–47). Right hand and both feet showed similar lesions.

Comment: This case also illustrates the importance of examining the feet roentgenographically whenever sarcoidosis is suspected. It is unusual that the osseous manifestations should be so sharply confined to a single terminal phalanx, with no recognizable change over a period of four years. It should be noted, however, that the patient's symptoms which prompted a diagnosis of gout were in her opposite foot. This, of course, strongly suggests that sarcoid granulomas in bone were more extensive than roentgenologic examination would indicate.

It is felt that this patient has sarcoidosis of the kidneys with secondary infection, which are combining to produce a picture of uremia, with anemia secondary to the latter disease. Roentgenologically demonstrable nephrocalcinosis such as was seen in pyelograms in this case has not been described previously in sarcoidosis to our knowledge. Interestingly enough, the single serum calcium level obtained in this patient to date was within normal limits.

CASE V: E. S., a 14-year-old colored boy, was first seen in the Department of Ophthalmology of the University Hospital on Nov. 5, 1945, where it was found that blindness in his right eye was due to chronic iridocyclitis. A routine admission photofluorogram of the patient's chest and subsequent 14 × 17-in. films (Nov. 12 and 20) showed superior mediastinal and bilateral hilar adenopathy (Fig. 13A) thought to be most suggestive of sarcoidosis. Subsequent films of the hands (Dec. 3, 1945) were negative (Fig. 13B); the feet were not examined roentgenographically.

Several small shotty nodules were found in the cervical, axillary, epitrochlear, and inguinal regions, and biopsy of an epitrochlear node showed "numerous epithelioid nodules" thought to be Boeck's sarcoid, although the presence of a small amount of caseation necrosis suggested the possibility of miliary tuberculosis. No acid-fast organisms could be found in the histologic sections, however, and the final clinical diagnosis was sarcoidosis.

A cataract was removed from the patient's eye in November 1946, and in January 1947 he began to have stiffness, swelling and slight pain in his right fifth finger. He returned to the hospital late in February 1947, when fusiform swelling of the left fifth finger developed.

Chest roentgenograms (March 4, 1947) showed marked diminution in extent of the previously described mediastinal adenopathy whereas, films of the extremities (March 4, 1947) showed for the first time numerous zones of bone destruction in the phalanges of both hands and both feet. Most of the lesions were manifest as "lace-like" areas of rarefaction, although several well circumscribed "punched-out" foci also were present (Fig. 13, B and D). The findings were considered to be typical of sarcoidosis.

Significant Laboratory Findings: Tuberculin (O.T.), 1:100 negative; Kahn negative; plasma cholesterol 212 mg. per cent; total serum proteins 9.5 gm. per cent; albumin 5.3 gm. per cent; globulin 4.2 mg. per cent; serum calcium 11.0 mg. per cent; inorganic phosphorus 5.3 mg. per cent; alkaline phosphatase 2.5 Bodansky units.

The patient was placed on a modified Charpy regime and check-up roentgenograms of the hands and feet, on April 18 and 29 and July 10, 1947, showed definite regression of a few of the bone lesions, but most of them either progressed slightly or remained stationary. The chest remained essentially unchanged.

It is of interest that in May 1947, two small papules developed on the left side of the patient's nose. Both were removed and showed a "mixed pyogenic and granulomatous reaction" without identifying characteristics. When the patient was last seen, Sept. 28, 1948, the general condition was improved and all of the soft-tissue swellings had disappeared. Unfortunately, roentgenograms of the hands and feet were not obtained on this occasion.

Comment: The interesting development of this patient's osseous lesions while the intrathoracic manifestations of his disease were regressing emphasizes the unpredictable character of sarcoidosis and underlines the importance of re-examining the extremities periodically even in the face of an initially negative bone survey. This, of course, is especially true when soft-tissue swellings of the digits or skin lesions in any portion of the body develop.

This case is the only reasonably good example in our group of the large, round "punched-out" type of lesion in the end of a phalanx such as developed and persisted in Jüngling's first patient over a period of at least fifteen years.

SUMMARY

Sarcoidosis is a fairly well established, generalized systemic disease of unknown etiology affecting primarily the reticuloendothelial system but capable of involving secondarily almost any portion of the

body. A historical review of medical reports dealing with the osseous manifestations of sarcoidosis indicates that such lesions were observed by a roentgenologist (22) as early as 1902, and that they have been considered an integral part of the disease since the memorable contributions of Schaumann and Jüngling in 1919.

The bone lesions of sarcoidosis have a peculiar predilection for the phalanges. Roentgenologically they usually are manifested as a diffuse, coarse, reticular type of bone destruction. The resulting alveolate or lace-like appearance is more common and more characteristic than the widely publicized circumscribed foci in the end of the bones which Jüngling first said "look as if they had been punched-out by a steel press." These localized, rounded defects may be simulated by numerous other conditions whereas the diffuse lesions are virtually pathognomonic. The diffuse forms may progress to produce mutilating deformities, may regress spontaneously, or may resolve themselves into the localized lesions which, on the whole, tend to be more chronic. Transitional or intermediate forms may be present in the same bone.

The roentgenologic manifestations of osseous sarcoid are relatively uncommon. Of 65 patients with generalized sarcoidosis seen at the University of Michigan in the past thirteen years, only 11 (approximately 16 per cent) had definite bone lesions. It is our feeling that if the entire "sarcoid population," including minimal and subclinical forms of the disease, could be tabulated, the incidence of bone lesions would prove to be considerably lower. Despite this low incidence, the unquestioned diagnostic value of demonstrable osseous involvement in a disease notoriously difficult to identify makes it highly desirable to examine routinely the hands and feet of all sarcoidosis suspects not only initially but periodically throughout the chronic course of the disease.

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SUMARIO

Lesiones Oseas de la Sarcoidosis

La sarcoidosis es una dolencia orgánica, generalizada, bastante bien establecida, de etiología desconocida, que afecta primariamente el aparato reticuloendotelial, pero susceptible de atacar secundariamente casi cualquier porción del cuerpo. Las manifestaciones óseas del mal fueron observadas por un roentgenólogo ya para 1902, habiéndose considerado como parte integrante del mismo desde los memorables aportes de Schaumann y Jüngling en 1919.

Las lesiones óseas de la sarcoidosis muestran una predilección peculiar hacia las falanges, manifestándose radiológicamente por lo general en forma difusa y grosera de tipo reticular. El resultante aspecto al-

veolado o calado es más frecuente y característico que los focos excavados circunscritos de las epífisis. Estas deformaciones redondeadas y localizadas pueden ser simuladas por otros muchos estados, en tanto que las difusas son virtualmente patognomónicas. Las últimas pueden avanzar hasta producir deformidades mutilantes, retroceder espontáneamente o resolverse en lesiones localizadas que, en conjunto, tienden a ser más crónicas. Puede haber en el mismo hueso formas de transición.

Las manifestaciones radiológicas de la osteosarcoidosis son relativamente raras. De 65 enfermos con sarcoidosis generalizada observados en la Universidad de Míchigan en los últimos trece años, sólo 11 (aproximadamente 16 por ciento) tenían lesiones óseas bien definidas. Creen los AA. que, si pudiera tabularse toda la "población sarcoidea," incluyendo las formas mínimas y subclínicas de la enfermedad, la incidencia de las lesiones óseas sería considerablemente menor. A pesar de ese bajo índice, el indudable valor diacrítico de la invasión ósea observable en una afección que es notoriamente difícil de identificar demuestra la gran conveniencia del examen sistemático de las manos y pies de todos los enfermos en que se sospeche sarcoidosis, no tan sólo inicialmente sino periódicamente durante toda la evolución crónica del mal.

DISCUSSION

Howard P. Doub, M.D. (Detroit, Mich.): It has been a distinct pleasure to listen to this complete and well documented description of the osseous lesions of sarcoidosis.

There are only a few things that we can say in discussing this paper. The reasons for examining the bones may be said to be two. One is to supply a fuller, well rounded clinical picture of the disease. The second is to prove the etiology of lesions found elsewhere in the body, for which the diagnosis is not clear. The demonstration of the osseous lesions will often establish the diagnosis of the more distant lesions as well.

Another interesting thing is the incidence of bone lesions, which has been placed at around 16 per cent. I think that this shows the importance of examining the osseous system in the presence of suspected sarcoidosis elsewhere in the body.

Just twenty years ago, I described two cases of bone involvement in sarcoidosis and Dr. Holt has asked me what further information we have on those cases. One patient disappeared; the other case was more completely studied and after a few years came to autopsy. We found nothing new except for the fact that there was an absence of lesions elsewhere in the body beyond those that we had already known. Previously we had taken off one of the fingers; we had made biopsies from the nasal septum, which was perforated, and also from the face. After our report appeared a man wrote me from South America stating that our patient did not have sarcoidosis but leprosy, as he had seen hundreds of such cases. We had studied the cases very carefully, however, and were sure that they were not leprosy.

I would again like to congratulate Dr. Holt. I believe his paper merits careful study.

Sydney F. Thomas,M.D. (Palo Alto, Calif.): I have one question. I wonder if x-ray therapy was used on any of these bone lesions.

Dr. Doub: We did try it, but with no results. However, others have tried it since.

Merrill C. Sosman, M.D, (Boston, Mass.): How many of those with bone lesions, particularly Negroes, were afflicted with skin lesions? I think that the two go together.

Dr. Holt (*closing*): So far as x-ray therapy is concerned, we have not tried it ourselves, but it has been used extensively by others. Just a short time ago, I was talking to Dr. Hansen from Denmark, and he said that in the Scandinavian countries they are quite enthusiastic about its use. It is difficult, however, to evaluate any form of therapy in sarcoidosis. Dr. Curtis of the Dermatology Department at our hospital has used a modified Charpy regime to treat these patients; this consists essentially of massive doses of Vitamin D_2. Although Dr. Curtis feels that some of the bone lesions have shown definite response, we in the x-ray department find it difficult to agree with him, because there really isn't anything on films that can't possibly be explained by spontaneous remissions or variations in technic.

The incidence of bone lesions is definitely higher in Negroes in our experience, Dr. Sosman. The Negro population in our hospital is not very high, but there is no question about the greater incidence. I think that I can give you exact figures in this group. Of 11 patients with definite bone involvement, 5 were Negroes. As far as associated skin lesions are concerned, all but one of the patients with bone involvement had associated skin lesions. We quite agree that they do develop together, although we don't believe that one can depend on this fact entirely, because McCort and his group found 6 patients with bone lesions in a group of Army men, none of whom had any external signs of sarcoidosis.

Clinical and Roentgen Aspects of Internal Biliary Fistulas

Report of Twelve Cases[1]

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INTERNAL BILIARY fistulas have been reported mainly on the basis of findings at surgery or necropsy. In an extensive review of the literature the incidence of such fistulas (in the larger groups reported) at the time of routine biliary surgery was found to be as follows:

TABLE I: INCIDENCE OF INTERNAL BILIARY FISTULA

	No. Cases Reported	Incidence in Biliary Surgery Series
Judd and Burden (1)	153	...
Bernhard (2)	109	1.7%
Kehr (3)	100	5.0%
Tracey and McKell (4)	21	...
Puestow (5)	16	3.2%
Hicken and Coray (6)	15	4.2%
Naunyn (7)	200	...

While many unusual fistulas have been described, the main types are cholecystoduodenal, cholecystocolic, and choledochoduodenal. Of 819 cases reported with surgical findings, only 9 per cent were in locations other than one of these three sites (Table II). Such a summary of the literature yields a total number of cases large enough for accurate evaluation of the anatomic and pathologic factors involved.

TABLE II: SUMMARY OF 819 REPORTED CASES OF INTERNAL BILIARY FISTULA

	Per Cent of Total Cases	Variation in Individual Groups
Cholecystoduodenal	51	44 to 57%
Cholecystocolic	21	5 to 37%
Choledochoduodenal	19	7 to 33%

ETIOLOGIC FACTORS

The reported frequency of the various etiologic factors of internal biliary fistula has been fairly consistent. Gallbladder calculi, as the primary cause, are listed in 85 to 90 per cent of all surgical series; these include principally the cholecystic fistulas. Garland and Brown (8) point out that "if a gallstone can be detected or there is a reliable history of its presence, a spontaneous internal biliary fistula is apt to be cholecystoduodenal." Tracey and McKell (4) state that, when stones are not found in a cholecystic internal fistula, one can suspect that they have been passed without the patient's knowledge. In the series of such cases reported from the Mayo Clinic (1), the approximate 3:1 ratio of females to males is in accord with the known sex incidence of cholelithiasis in relation to the development of fistulas. This association is well demonstrated by the following cases of cholecystoduodenal fistula (Cases I–III).

CASE I (C. H.): One week prior to emergency admission to the hospital, an 85-year-old white woman began to experience progressive flatus and epigastric distention. Two days preceding hospitalization, there was increasing upper abdominal distention, with associated vomiting. Examination showed the upper abdomen to be distended and revealed visible peristalsis. A clinical diagnosis of obstruction of the small intestine was made. The white blood cell count was 20,000, with 95 per cent polymorphonuclears.

X-Ray Studies: Barium enema films were not remarkable except for atypical gas shadows in the right upper quadrant, apparently of gallbladder origin (Fig. 1A). There was no evidence of intestinal obstruction. Gastro-intestinal films were then obtained, but unfortunately surgical exploration was performed prior to their interpretation. The reported operative finding was duodenal obstruction by an indurated mass including the omentum, diagnosed grossly as a malignant neoplasm. A gastro-enterostomy was performed.

Subsequent interpretation of the gastro-intestinal

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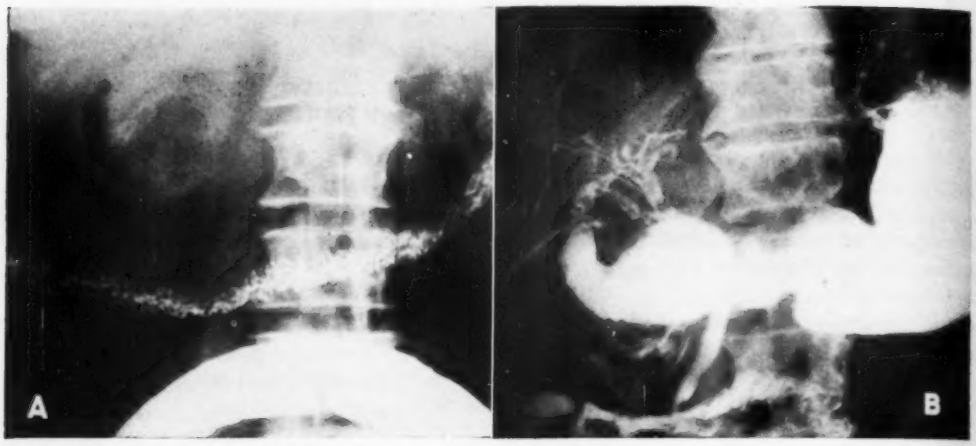

Fig. 1. Case I: Cholecystoduodenal fistula from large perforating calculus in gallbladder fundus. In B, note barium filling the gallbladder and duct system and obscuring the calculus.

Fig. 2. Case II: Cholecystoduodenal fistula. Non-opaque perforating calculus and barium outlining the gallbladder and cystic duct.

films showed an unusually large rounded duodenal bulb with a central lobular defect. The biliary tree was partially filled by barium through a fistulous opening between the duodenal bulb and the fundus of the gallbladder (Fig. 1B).

Postoperatively the roentgenologic diagnosis of perforating cholelithiasis with cholecystoduodenal fistula was dubiously received, but several hours following surgery the patient considerately vomited the large perforating calculus!

CASE II (M. G.): No history was obtained on this elderly white woman, who was a mental patient at the time of the diagnosis of cholecystoduodenal fistula. Surgery was not performed, but the patient was known to be living ten years after initial diagnosis.

X-Ray Studies: A gastro-intestinal series showed the biliary tree and gallbladder well outlined by barium. A large round filling defect was present supraduodenally in the fundus of the gallbladder. The roentgen diagnosis was perforating cholelithiasis with cholecystoduodenal fistula (Fig. 2).

CASE III (R. W.): A 54-year-old white man gave a history of recurrent attacks of right upper quadrant pain with associated dyspnea and a low-grade fever for one year. There was no history of jaundice. Laboratory studies showed a white blood count of 10,500, with 84 per cent polymorphonuclears.

X-Ray Studies: A scout film of the abdomen revealed an air pattern partially outlining the gallbladder and biliary ducts (Fig. 3). Gastro-intestinal studies and a barium enema examination both failed to reveal a fistulous tract or to demonstrate any barium in the biliary system. The gallbladder was not visualized by cholecystography. The final diagnosis was probable cholecystocolic fistula.

Abdominal laparotomy was performed elsewhere and showed the gallbladder fundus densely adherent to the anterior surface of the first part of the duodenum. A large fistulous opening was blocked by a calculus 3 cm. in diameter, apparently too large to enter the duodenal lumen at that point. The patient died postoperatively of acute cardiac decompensation.

The determining factor for fistula formation in the presence of cholelithiasis, according to Hicken and Coray (6), is probably choledochal obstruction, and Taylor (9) states that such fistulas remain

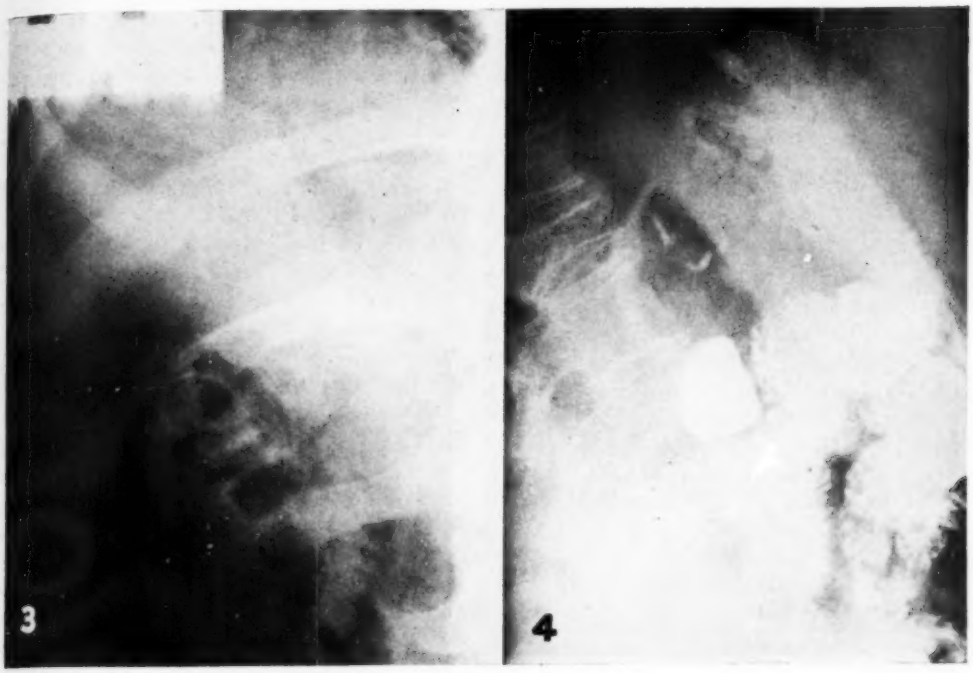

Fig. 3. Case III: Cholecystoduodenal fistula. Air outlines the gallbladder and hepatic ducts. A non-opaque perforating calculus blocked the fistula, preventing its filling with barium.
Fig. 4. Case IV: Cholecystoduodenal fistula. A cystic-duct calculus was thought to be present, permitting barium to fill only the gallbladder and cystic duct.

patent only as long as common duct obstruction persists (Fig. 8). Included among Puestow's reported cases was cystic-duct rather than common-duct blockage. This possibility, plus drainage by way of the fistula itself, could account for the frequent absence of jaundice in these cases without negating the possibility of an obstructive factor. The following case exhibited blockage of the cystic duct, with a cholecystoduodenal fistula.

CASE IV (E. K.): A 77-year-old white woman, a psychiatric patient from whom no previous history could be obtained, had symptoms of sudden onset, including recurrent attacks of vomiting, marked malaise, and severe upper abdominal pain. Physical examination revealed right upper quadrant tenderness and muscle guard. The temperature was 102.5° F.

X-Ray Studies: A flat plate of the abdomen showed increased density in the right upper quadrant without definite abnormal air patterns. Gastro-intestinal study revealed a fistula extending from the posterior lateral surface of the proximal second part of the duodenum. The gallbladder and cystic duct were filled with barium without evidence of opaque material in the remainder of the biliary system (Fig. 4). The patient responded to sulfadiazine therapy and surgery was not done.

Garland and Brown (8) have shown clearly the dominant role of perforating duodenal ulcer in fistulas connecting with the common bile duct. Ulcers accounted for 80 per cent of their collected series of choledochoduodenal cases. Of all internal biliary fistulas found at surgery, 6 per cent are attributable to duodenal ulcer. The gallbladder was invariably involved in the cases reported as being due to a gastric ulcer.

In its advanced stages, cancer of either the gastro-intestinal or biliary tract can invade widely enough to cause an internal biliary fistulous tract. While primary gastric cancers are the more common, their infrequency of perforation accounts for the rarity of associated fistula formation.

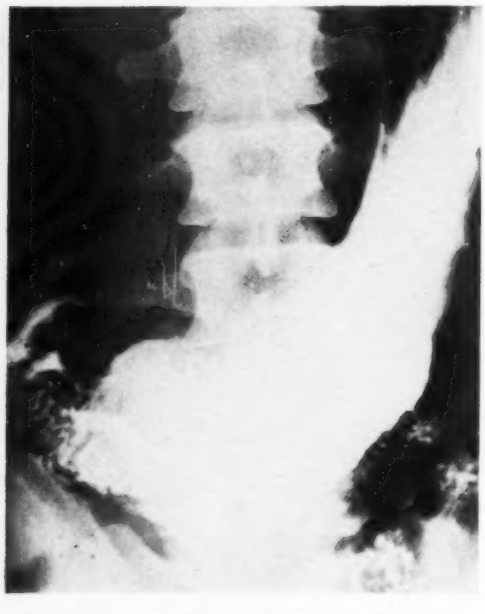

Fig. 5. Case V: Gastropancreatic-duct fistula associated with an extensive gastric carcinoma. The terminal pancreatic duct posterior to the gastric mass is filled with barium.

Primary malignant growths of the pancreas and bile ducts are more frequent etiologic factors (5, 6). The rarer complex fistulous tracts are most often concomitant with the presence of a malignant growth.

CASE V: A white man, age 69, entered the hospital complaining of weakness, anorexia, and vomiting of eight months duration. Physical examination revealed a large nodular epigastric mass, apparently associated with hepatic enlargement.

X-Ray Studies: Gastro-intestinal studies showed an extensive neoplasm extending from the gastric antrum to the pylorus, with fixation posteriorly (Fig. 5). The proximal portion of the pancreatic duct was outlined by opaque material.

CLINICAL ASPECTS OF INTERNAL BILIARY FISTULA

Attempts by several authors to establish an identifying clinical picture have yielded very few findings pathognomonic of spontaneous internal biliary fistulas. Such signs as unusually severe biliary colic, recurrent symptomless periods, and sudden cessation of colic with signs of sepsis have been considered. In the cases comprising this report, the clinical findings were not consistent and, in accordance with the observations of Hicken and Coray, the presenting syndrome was that of the underlying pathologic condition from which the fistula arose. The one sign which makes a clinical diagnosis of internal fistula fairly definite is the presence of a sizable biliary calculus in the feces or vomitus. Cases I, IX, and XIII exhibited this sign. In Case XIII passage of a calculus was somewhat deceptive, for it was associated not only with a colic fistula but also with an epidermoid carcinoma of the gallbladder.

The establishment of a diagnosis of internal biliary fistula presents a therapeutic problem. Many authors have emphasized strongly that fistula formation, even though it may afford temporary or occasional relief of symptoms, represents not a cure but an additional pathologic condition. Using experimental animals, Beaver and others have proved that a persistent free communication between the gastro-intestinal tract and bile ducts results in progressive liver damage. In cases concurrent with malignant neoplasms this potential damage is obviously not a major factor, but its importance in cases associated with benign lesions has been well shown in the effect on later operative mortality (1, 3, 4).

In argument against this danger, it must be admitted that elective biliary-upper intestinal anastomosis has never conclusively been shown to affect hepatic function adversely. Also, cases of internal biliary fistula of long duration have been reported, including that of Eliason and Stevens (10), in which it was believed that the cholecystoduodenal tract had been present for nineteen years before the patient succumbed to the primary biliary-hepatic disease. Three of the cases of cholecystoduodenal fistula here reported were followed without correction of the fistula and with no evidence of later symptoms or harmful effects (Cases II, IV, and VII), in one case (II) for as long as ten years. It would seem probable that in such cases relief of the

duct obstruction, passage of the offending calculus, and healing have occurred. However, a persistent colic fistula would certainly present an added danger of future infection. This is well exemplified in Case IX, in which a cholecystocolic fistula of four months duration remained patent without perforating calculus or duct obstruction; apparently it was due to severe infectious changes. Cholangitis and hepatic damage were not present at the time of surgery but the removed gallbladder exhibited marked inflammatory changes and a heavy culture of *B. coli* was obtained in bile aspirated from the common bile duct.

Some fistulas undoubtedly close spontaneously after passage of the offending calculus. Hicken and Coray cite two such cases, in which exploration revealed only evidence of the healed gallbladder fistula. The following case, observed recently, demonstrated this on roentgenologic study.

CASE VI (O. H.): A 73-year-old white woman gave a history of recurrent right upper quadrant pain with associated nausea and vomiting. Two months prior to admission she had experienced an unusually severe attack followed by marked icterus. One week later she passed by rectum what was thought to be a hard fecal nodule, with subsequent subjective relief and subsidence of the jaundice. Physical examination revealed marked right upper quadrant tenderness and muscle guard without evidence of hepatic enlargement or an associated mass. There was no icterus or fever at that time. A clinical diagnosis of internal biliary fistula was made. Laboratory studies showed a normal blood picture.

X-Ray Studies: A scout film was not remarkable except for an unusual air pattern in the right upper abdomen (Fig. 6). Gastro-intestinal studies revealed a retentive barium niche off the distal hepatic flexure of the colon without evidence of contrast material in the biliary tree. A barium enema provided no further information. These findings were interpreted as indicative of a healing cholecystocolic fistula. The patient was discharged without surgery and the course has been satisfactory.

It is an opinion that the persistence or regression of the prerequisite duct obstruction plays a major role both in maintaining fistula patency in benign lesions and in the production of hepatic damage. With the exception of cases presenting a history of benign duodenal ulcer yielding to medical management (Case XII), the majority of reported persistent biliary fistulas have necessitated surgical correction for a clinical cure.

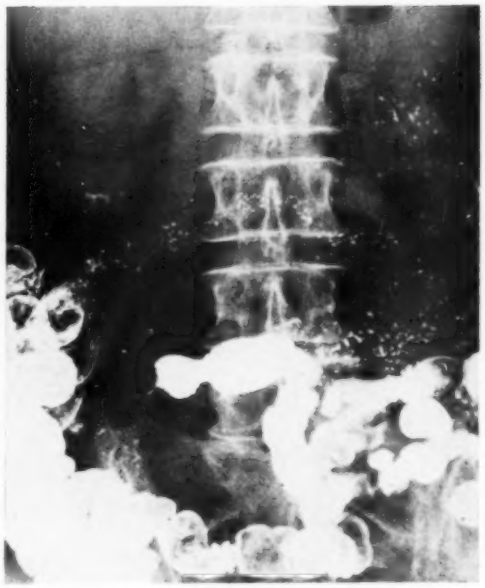

Fig. 6. Case VI: Cholecystocolic fistula (healing). A small retentive pocket was demonstrable superior to the hepatic flexure.

ROENTGENOLOGIC DIAGNOSIS

Roentgenologic study is the only method for definite preoperative diagnosis of internal biliary fistulas. A review of the literature by Garland and Brown in 1941 showed 90 cases to have been correctly diagnosed by roentgen studies. Such a diagnosis, however, is exceptional in the reported surgical series. That this is primarily due to the small number of these cases which are studied preoperatively by x-ray is suggested by the accuracy of the roentgen diagnosis in the cases thus examined. The apparently typical cholelithiasis attack or the acuteness of the case prompts the surgeon to omit gastro-intestinal studies in favor of immediate surgery. In cases exhibiting such symptoms, considerable aid to correct diagnosis is offered in routine scout films of the abdomen. In the series here reported, 75 per cent, or all cases in which the gallbladder was involved

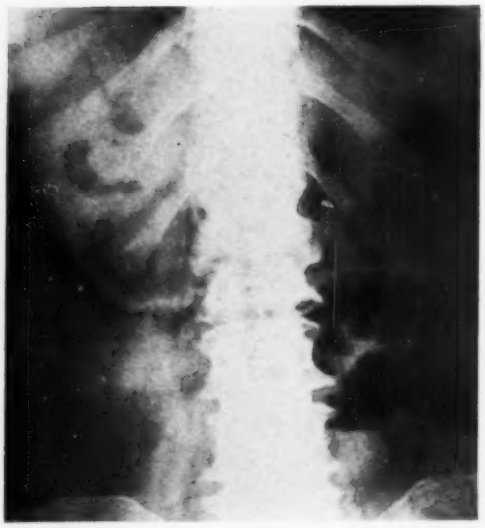

Fig. 7. Case VII: Cholecystoduodenal fistula with associated obstruction of the distal ileum by the non-opaque perforating calculus.

were diagnosed, at least tentatively, by this procedure. It is also suggested by Powers (12).

The basis for diagnosis has been well presented in many excellent articles. The presence of air or contrast material from the gastro-intestinal tract in the biliary system is the fundamental criterion. The significance of gallstone obstruction of the intestine as evidence of an internal biliary fistula has been discussed in recent literature (11). Powers presents a case diagnosed on finding a solitary faceted calculus in the gallbladder (12).

CASE VII (A. F.): Three years previous to admission a 75-year-old white man had a cholecystotomy, following which an external biliary fistula appeared. There had been associated indigestion, which had become more severe three months after spontaneous closure of the fistula. On the day of admission, obstructive symptoms had suddenly developed, with vomiting and epigastric cramping. Physical examination revealed generalized abdominal distention and tenderness. The temperature was 101° F. The white blood cell count was 6,000, with 92 per cent neutrophils.

X-Ray Studies: A scout film of the abdomen revealed the biliary system partially outlined by air (Fig. 7). Several dilated loops of small intestine were seen. There was no evidence of opaque calculi.

Surgical exploration revealed an obstructing biliary calculus in the distal ileum. The stone was removed, but because of many adhesions in the gallbladder area, no attempt was made to repair the cholecystoduodenal fistula.

In view of the limited study possible in many of these cases, the value of air patterns is foremost in importance. Of the

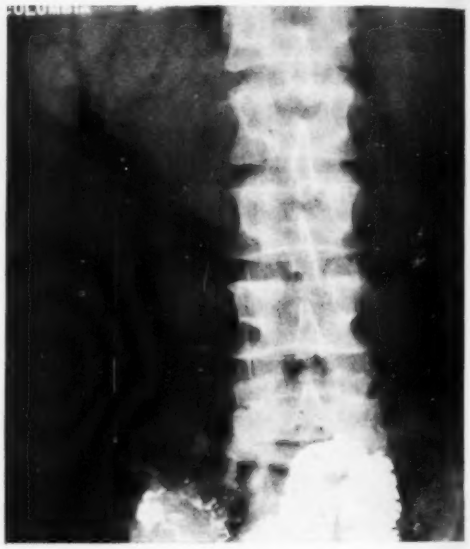

Fig. 8. Case VIII: Cholecystocolic fistula with a laminated opaque calculus blocking the terminal common duct.

90 cases collected from the literature by Garland and Brown, 9 were said to have been diagnosed by air in the biliary ducts. Abnormal air patterns were present on the scout films in all of our cases of fistula involving the gallbaldder. With colic fistulas this finding permitted a final diagnosis but with duodenal involvement, it was usually sufficient only for a preliminary conclusion. The choledochal fistulas and fistulas due to malignant lesions did not offer such air patterns preliminary to their diagnosis by barium gastro-intestinal studies. The following cases of cholecystocolic fistula clearly exhibit this feature.

CASE VIII (J. J.): A 66-year-old white man gave a history of intermittent colicky epigastric pain beginning six months prior to admission. Three months following its onset this discomfort ceased, but severe daily chills developed, with temperature

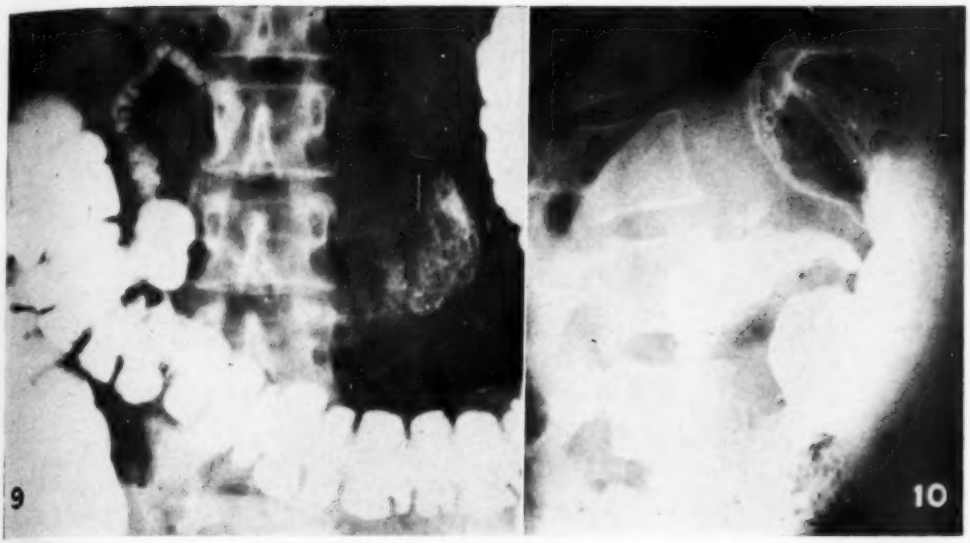

Fig. 9. Case IX: Cholecystocolic fistula due to perforating calculus. The gallbladder, biliary ducts, duodenum, and stomach contain barium from the enema.

Fig. 10. Case X: Incompetent sphincter of Oddi. Surgical exploration established the reflux basis for the barium in the distal common duct.

elevation, jaundice, and acholic stools. These symptoms subsided after two months. At the time of admission the only complaints were low-grade fever, anorexia, and a weight loss of 29 pounds. Laboratory studies revealed an icterus index of 29; all liver function tests showed impairment, and stool specimens were positive for occult blood. The clinical diagnosis was probable carcinoma of the pancreas.

X-Ray Studies: A scout film of the abdomen (Fig. 8) revealed a laminated faceted calculus 1 cm. in diameter on the right, lateral to the third lumbar intervertebral space. Air was present throughout the greater portion of the biliary tree, and the common duct was markedly dilated. Following a barium meal, the 24-hour film showed an abnormal shadow at the crest of the right ilium, extrinsic to the colonic tract. A diagnosis of cholelithiasis with cholecystocolic fistula was made.

At operation the fistula was found between the proximal transverse colon and gallbladder fundus. The common duct was partially blocked by the calculus described above.

CASE IX (G. H.): A 52-year-old white woman gave a three-year history of recurrent attacks of severe right upper abdominal pain associated with nausea and vomiting. Six weeks prior to admission she suffered a mild attack followed by marked constipation, and several days later, three large calculi were passed by rectum. At admission the chief complaints were anorexia and epigastric discomfort. Physical examination revealed minimal deep tenderness in the right upper quadrant. The temperature was 101° F. The white blood cell count was 7,400, with 91 per cent neutrophils. The icteric index was 10.5.

X-Ray Studies: On the scout film of the abdomen, the gallbladder and biliary tree were well outlined by air. A barium enema demonstrated filling of the biliary system through a cholecystocolic fistula (Fig. 9).

The patient left the hospital and returned two months later for surgical treatment. At surgery a 1-cm. fistula was found between the fundus of the gallbladder and the proximal transverse colon. The gallbladder wall was markedly inflamed. The common bile duct presented minimal dilatation. There were no calculi, and no evidence of cholangitis or hepatic damage. A culture of bile aspirated from the common duct showed a heavy growth of *B. coli.*

Acute emphysematous cholecystitis and regurgitation, associated with an incompetent sphincter of Oddi are mentioned as pitfalls in diagnosing an internal biliary fistula when such a diagnosis is based on the presence of air in the biliary system (6, 9). We have not observed the former condition. In one of our two cases of incompetent biliary sphincter, an abnormal air pattern was observed on the scout film. The opinion has been expressed that the incompetency of the sphincter is the result of a pathologic condition in the area of the

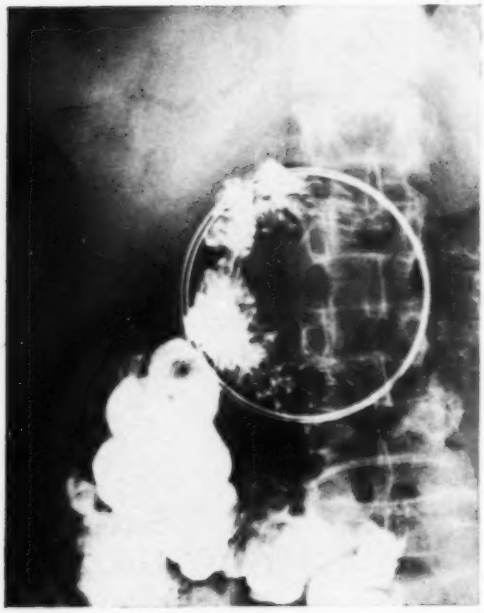

Fig. 11. Case XI: Incompetent sphincter of Oddi. With pressure cone the terminal common bile duct was filled faintly with barium by reflux. Air patterns were demonstrable in the hepatic ducts.

duodenal papilla, and this proved to be true on exploration in the following cases. In both, cholecystectomy had previously been done.

CASE X (W. L.): A 49-year-old white man gave a history of cholecystitis with cholelithiasis and jaundice relieved by cholecystectomy four years prior to admission. Two weeks previous to entry he had a sudden attack of upper abdominal pain, distention, and jaundice, which gradually subsided. Physical examination was not remarkable. The white blood cell count was 13,100, with 80 per cent neutrophils. Cholesterol flocculation was three plus, and stool specimens were positive for occult blood.

X-Ray Studies: A scout film of the abdomen showed a 1-cm. opaque body in the right costovertebral angle in the terminal common duct area. No air was apparent in the biliary system. On gastro-intestinal study, barium was observed in the common duct, extending for 3 cm. superior to the junction of the first and second portions of the duodenum (Fig. 10). Definite mural infiltrative changes were present in the proximal greater curvature aspect of the duodenal bulb. It was believed that this picture represented a choledochoduodenal fistula due to a calculus.

At exploratory laparotomy, however, one week later, no calculus was found. The common duct was moderately dilated and the posterior wall of the duodenal bulb was considerably thickened by old inflammatory changes. On opening the duodenum, the duodenal papilla was present in a high position, with a dilated patent sphincter.

CASE XI (E. M. B.): A 57-year-old white woman had undergone cholecystectomy for acute cholecystitis fifteen years previous to admission. One year later she developed jaundice, which subsided after six weeks. Since that time there had been recurrent attacks of right upper quadrant pain, with nausea and vomiting, and several episodes of hematemesis. Physical examination revealed tenderness deep in the right upper abdomen. All laboratory studies were within normal limits.

X-Ray Studies: Scout films of the abdomen showed abnormal air patterns in the right lateral midlumbar area. Several of the hepatic ducts were outlined by air. Barium enema examination was negative; there was no evidence of a colic fistula. A gastro-intestinal study revealed a normal duodenal mucosal pattern. Deep tenderness was present in the area of the head of the pancreas and, on pressure, barium was visualized in the terminal common duct (Fig. 11).

The final diagnosis was incompetent common duct sphincter, secondary to an old pathologic condition resulting from common duct calculi.

Reflux barium filling of the terminal bile duct has been described by Reimann, Eliason and Stevens (10), and others. In keeping with reports, the filling in our two cases involved principally the distal portion of the common bile duct. From a differential point of view, it is of interest that in only two of the cholecystic fistula cases was the terminal common duct filled with barium, and in both the remainder of the duct system was also outlined. The choledochal groups present the major differential problem. This is shown by the following case, which required fluoroscopic observation to determine definitely the site of entry into the biliary system.

CASE XII (E. B.): A 71-year-old white man gave a history of cholecystectomy twenty-six years earlier for cholecystitis. Six months prior to admission he began to suffer from intermittent epigastric pain, which had been partially controlled by peptic ulcer therapy. At the time of admission the pain had become continuous. Laboratory studies revealed a slightly elevated white blood count and a sedimentation rate of 30 mm. per hour.

X-Ray Studies: A scout film of the abdomen was not remarkable. Gastro-intestinal study showed a deformed duodenal bulb with a mural defect which communicated with the common bile duct. The

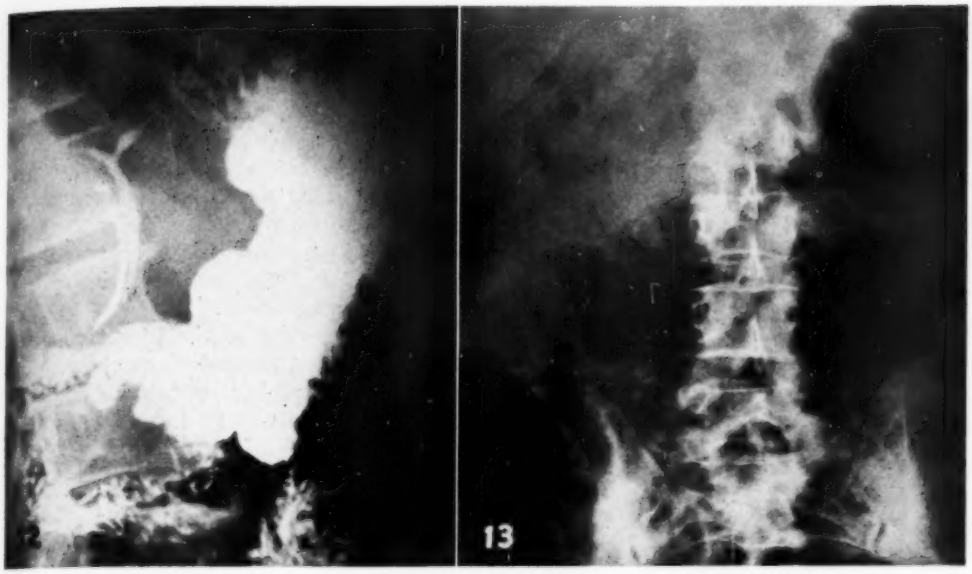

Fig. 12. Case XII: Choledochoduodenal fistula on the basis of a duodenal ulcer. The cystic duct is filled to the point of previous ligation at cholecystectomy.
Fig. 13. Case XIII: Cholecystocolic fistula due to an epidermoid carcinoma of the gallbladder; associated perforating calculus and subhepatic abscess.

common bile duct, common hepatic duct, and remaining distal portion of the cystic duct were well filled by barium (Fig. 12). The roentgenologic diagnosis was duodenal ulcer with associated choledochoduodenal fistula.

Exploratory laparotomy revealed an indurated mass about the duodenal bulb and bile duct. The fistulous tract was not demonstrated, and no attempt was made to repair the fistula. The mass was believed by the surgeons to be malignant.

Two months later the patient was again seen with exaggeration of the previous symptoms. A repeat gastric examination showed an increase of mural inflammatory changes in the duodenum. In addition, there was a 1-cm. shallow mucosal ulceration on the lesser gastric curvature. The choledochoduodenal fistula remained demonstrable.

The patient was placed on ulcer therapy by his local physician, and at follow-up examination three months later, the fistula and duodenal ulceration were healed.

With only one exception, all benign cases studied presented conspicuous demonstration of the fistula on barium studies. In Case III the fistula was not demonstrable, except by air filling, due to blockage by a large non-opaque perforating calculus. Apparently because of the mass and associated infiltrative changes, the few malignant cases showed a variable roentgenologic pattern. One revealed abnormal air patterns on the scout film.

CASE XIII (G. R.): For nine months a 43-year-old white woman had recurrent right upper quadrant pain associated with nausea and vomiting. During that time she had lost approximately 40 pounds in weight. Physical examination revealed a hard mass, 6 × 6 cm., in the right upper quadrant, which moved on respiration. The icteric index was 20, and the white blood count was 28,050, with 93 per cent polymorphonuclears. Liver function tests revealed impairment. Aspiration of the mass yielded necrotic purulent material diagnosed microscopically as acute inflammatory exudate. Two days after admission the patient passed two faceted calculi in the feces, which were shown on chemical analysis to contain cholesterin. The clinical diagnosis was subhepatic abscess secondary to cholelithiasis and formation of a cholecystocolic fistula.

X-Ray Studies: Scout films of the abdomen showed an increased density throughout the right upper quadrant, with abnormal air patterns in the area. The right diaphragm was elevated. An attempted barium enema study revealed a poorly defined fistula extending superiorly between the proximal transverse colon and subhepatic area. There was no contrast material in the biliary ducts.

Surgical drainage of the abscess was done, and an ileostomy performed to divert the fecal stream, but

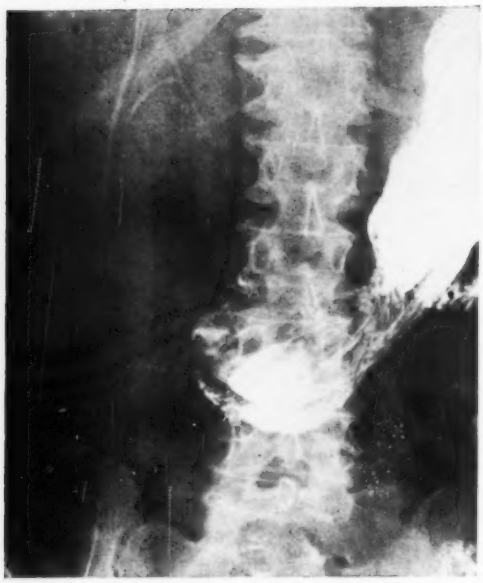

Fig. 14. Case XIV: Choledochoduodenal fistula associated with an extensive adenocarcinoma of bile-duct origin.

one month later the abscess was still draining. On digital re-exploration through the drainage site, a fragment of tissue from the abscess wall was obtained which was diagnosed microscopically as epidermoid carcinoma, probably primary in the gallbladder.

CASE XIV (E. J.): A 58-year-old white woman gave a history of right upper quadrant pain five months previous to admission, which lasted two weeks and then disappeared. One month before admission the pain returned and was associated with progressive jaundice and acholic stools. Physical examination revealed a hard, rounded, subhepatic mass with associated liver enlargement. Laboratory findings included an icteric index of 70 and a white blood count of 13,800 with 86 per cent polymorphonuclears. Liver function tests showed impairment. Stool examinations were positive for occult blood (4 plus). The clinical diagnosis was probable common duct calculus with gallbladder distention and associated hepatitis.

X-Ray Studies: Scout films did not reveal abnormal air patterns or opaque biliary calculi. The right diaphragm was elevated by hepatic enlargement. An indefinite mass was apparent in the gallbladder area. Gastro-intestinal study showed displacement of the duodenal bulb, a choledochoduodenal fistula, and a small amount of barium in the biliary system (Fig. 14).

Exploratory laparotomy revealed a large mass replacing the gallbladder and extending downward along the biliary tree. Biopsy showed adenocarcinoma of probable bile-duct origin.

CONCLUSIONS

1. A review of 819 reported cases of internal biliary fistula found at surgery showed 91 per cent to involve the colon or duodenum.

2. Cholelithiasis was the causative factor in 85 to 90 per cent of the reported cases; these involved principally the gallbladder. Duodenal ulcer accounted for approximately 6 per cent, involving chiefly the common bile duct.

3. In a review of the literature prior to 1941 (Garland and Brown) only 90 cases of internal biliary fistula diagnosed roentgenologically were found.

4. Twelve additional cases are reported. On the basis of these, the following observations were made:

(*a*) The clinical findings were not consistent. Only cases due to a malignant growth presented a palpable mass.

(*b*) Scout films of the abdomen played an important role in diagnosis, revealing abnormal air patterns in all cases involving the gallbladder (approximately 70 per cent of the series).

(*c*) In cases of cholecystocolic fistula, the air patterns on the survey films were adequate for a final diagnosis; in cholecystoduodenal fistulas such patterns were less marked and usually sufficient only for preliminary conclusions.

(*d*) Diagnostic air patterns on scout films were not observed in the choledochal fistulas or fistulas associated with malignant growths.

(*e*) All fistulas were easily demonstrated by barium studies of the gastro-intestinal tract, with the exception of those blocked by a malignant mass or perforating calculus.

(*f*) Persistent duct obstruction or failure to pass a perforating calculus apparently maintains the patency of fistulas involving the duodenum. With involvement of the colon, severe secondary infection is an added factor for persistence of the fistula.

NOTE: Since submission of this article, an additional case of perforating cholelithiasis with associated cholecystoduodenal fistula has been diagnosed. It presented the features already described, namely,

an abnormal air pattern on the scout film, with adequate filling on barium meal studies.

Surgical exploration showed a patent duct system with subsiding inflammatory changes in the area of the cystic duct and apparent progressive closure of the fistulous tract to millimeter size. The perforating calculus had been passed through the fistulous tract.

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SUMARIO

Aspecto Clínico y Radiológico de las Fístulas Biliares Internas: Comunicación de Dóce Casos

Un repaso de 819 casos comunicados de fístula biliar interna descubierta al operar reveló que en 91 por ciento estaban afectados el colon o el duodeno. La colelitiasis fué el factor etiológico en 85 a 90 por ciento de los casos comunicados, afectando principalmente la vesícula biliar. A la úlcera duodenal correspondía aproximadamente 6 por ciento, afectando mayormente el colédoco.

En un repaso de la literatura anterior a 1941 (Garland y Brown), sólo se encontraron 90 casos de fístula biliar interna descubiertos radiográficamente.

Comunícanse ahora doce casos, a base de los cuales se hacen las siguientes observaciones:

(*a*) Los hallazgos clínicos no fueron constantes. Sólo los casos debidos a neoplasia maligna presentaban tumefacción palpable.

(*b*) El importante papel jugado por las películas exploradoras del abdomen quedó demostrado por el hecho de que había imágenes anormales de aire en todos los casos que afectaban la vesícula biliar (aproximadamente 70 por ciento de la entera serie).

(*c*) En los casos de fístula colecistocólica las imágenes de aire en las radiografías exploradoras resultaron adecuadas para hacer el diagnóstico definitivo, en tanto que en los de fístula colecistoduodenal eran menos pronunciadas y por lo general no bastaban más que para sacar conclusiones preliminares.

(*d*) En las fístulas coledocales o en las asociadas a lesiones malignas no se observaron imágenes diacríticas de aire en las películas exploradoras.

(*e*) Exceptuadas las obstruídas por tumefacción maligna o cálculo perforante, todas las fístulas fueron descubiertas fácilmente con estudios con bario del tubo gastrointestinal.

(*f*) La persistente obstrucción del conducto o la retención de un cálculo perforante mantienen aparentemente la permeabilidad de las fístulas que afectan el duodeno. Al afectarse el colon, la intensa infección secundaria constituye un factor más en pro de la persistencia de la fístula.

Early Roentgen Recognition of Lower-Lobe Tuberculosis[1]

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BECAUSE OF THE old dictum that reinfection tuberculosis has a preference for the apices and immediately infraclavicular regions, lesions in other locations are too often missed or, if noted, are considered non-tuberculous until a sputum test proves positive. Actually, lower-lobe tuberculosis is not at all uncommon. It has, moreover, characteristic roentgen features which we believe should suggest the true nature of the disease at an early stage.

INCIDENCE

The incidence of lower-lobe tuberculosis as reported in the literature varies from a small fraction of 1 per cent (3), through a middle group of 2 to 6 per cent (1, 4, 7, 9, 10), to almost 30 per cent in one series of nurses reported by Ross (8). As Reisner (6) and Weidman and Campbell (11) have emphasized, this discrepancy is due to three factors: first, failure to obtain a lateral view; second, examination late in the course of the disease; finally, the confusion that exists in the use of the terms "basal tuberculosis," "lower-lobe tuberculosis," "hilar tuberculosis," and "perihilar tuberculosis." Actually the hilar and perihilar forms are in the apex or subapical region of the lower lobe. It is only the overlapping of shadows in the postero-anterior view that makes the lesion appear to be connected with the hilus. In the lateral view it is seen to be well separated from the hilar structures. Inclusion of these "perihilar" lesions in the lower-lobe group greatly increases the incidence of the latter form of the disease.

Infiltrations even in the infraclavicular regions may well be in the apices of the lower lobes, which quite frequently extend higher than is commonly supposed (Medlar 5). The lateral view shows them to be well posterior, in the paravertebral gutter, below the interlobar fissure. These are true lower-lobe lesions, even though they are not in the very base of the lung. Less commonly, the disease may be confined to the extreme base, and many think of this form only as lower-lobe tuberculosis. Even this position is not exceedingly rare (8, 10), but the lesions are usually misdiagnosed as bronchiectasis for a considerable period.

The time of diagnosis must also be taken into consideration. A lesion which begins in the lower lobe frequently spreads to the upper, and the true sequence of events is then confused. The fact that so many lower-lobe lesions have been found in nurses (Ross, 8) may be partly accounted for by the fact of early diagnosis.

On one point almost all observers have agreed: lower-lobe lesions are much more common in young females, and show a decided preference for the right side. The incidence is probably also higher in diabetics (1, 2). The reasons for this are obscure.

ROENTGEN DIAGNOSIS

Lower-lobe tuberculous lesions may be divided into two broad groups: first, transverse streaks of infiltration in the perihilar area, or just above or below it; second, smaller or larger areas of consolidation, often with cavity formation, sometimes involving the whole lobe. These types depend primarily on the stage in which the disease is first found. The rate of progression, as in tuberculosis elsewhere, is extremely variable. A number of authors, however, have called attention to early cavity formation.

[1] From the Department of Radiology, Philadelphia General Hospital, Dr. Bernard P. Widmann, Chief. Accepted for publication in May 1948.

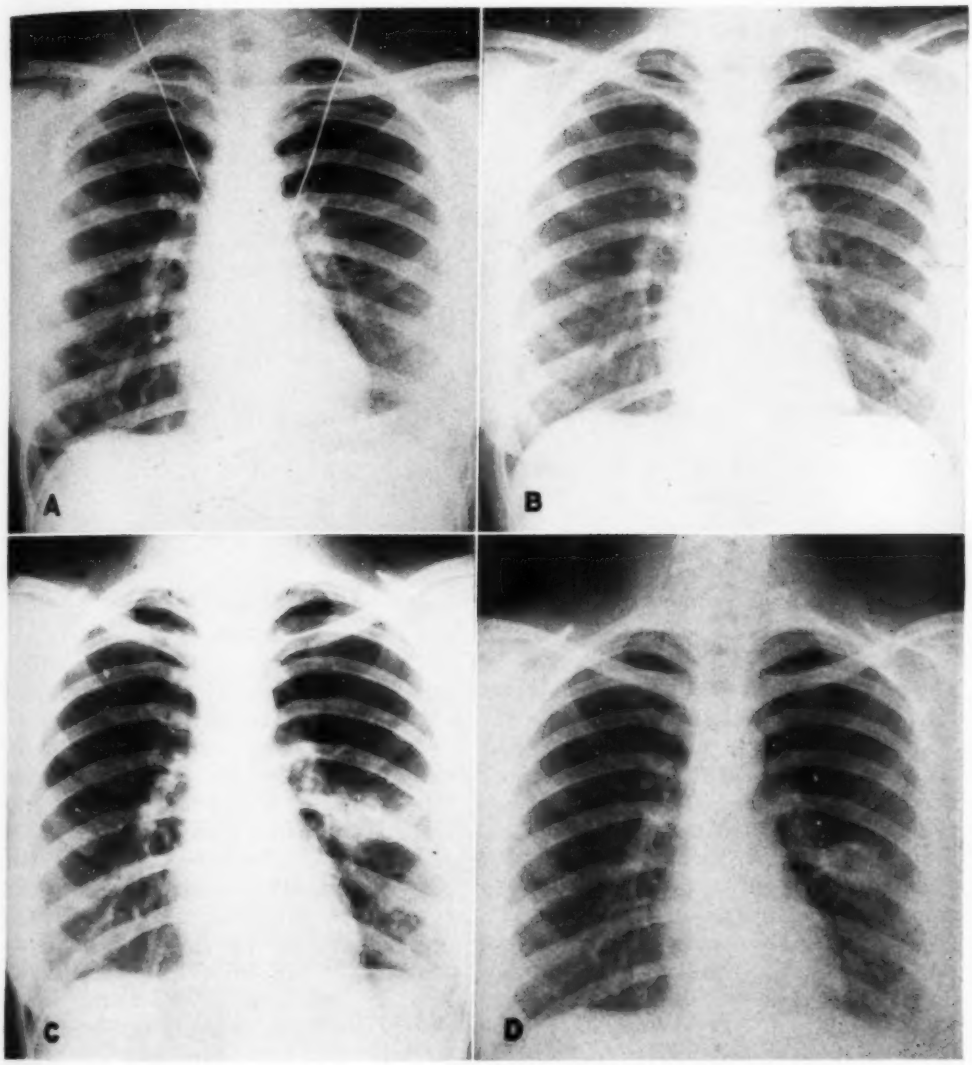

Fig. 1. Case 1: C. W., white female, 20 years, nurse.

A. May 1941. Fine soft infiltration extending from left hilus transversely to periphery. There is pleurisy at the left base.

B. March 1942. The pleurisy has subsided. There is now a nodule in the left third interspace.

C. June 1942. Progression, with heavy transverse infiltration. A lateral view showed this to be in the subapical portion of the lower lobe.

D. June 1945. There is now a large cavity with a fluid level. Little surrounding lung reaction is present. The cavity healed slowly, but in 1947 there was a new lesion in the left upper lobe.

Our purpose is to illustrate the first of the two types just mentioned, *i.e.*, the early lesions which are present at the time the diagnosis should be made and treatment started. These early infiltrations consist of rather soft, transverse, often beaded lines extending, in the postero-anterior view, from the hilus or perihilar region transversely into the lung field, often to the periphery. At times they may be widely separated from the hilar region, occurring in the lateral portion only. It is

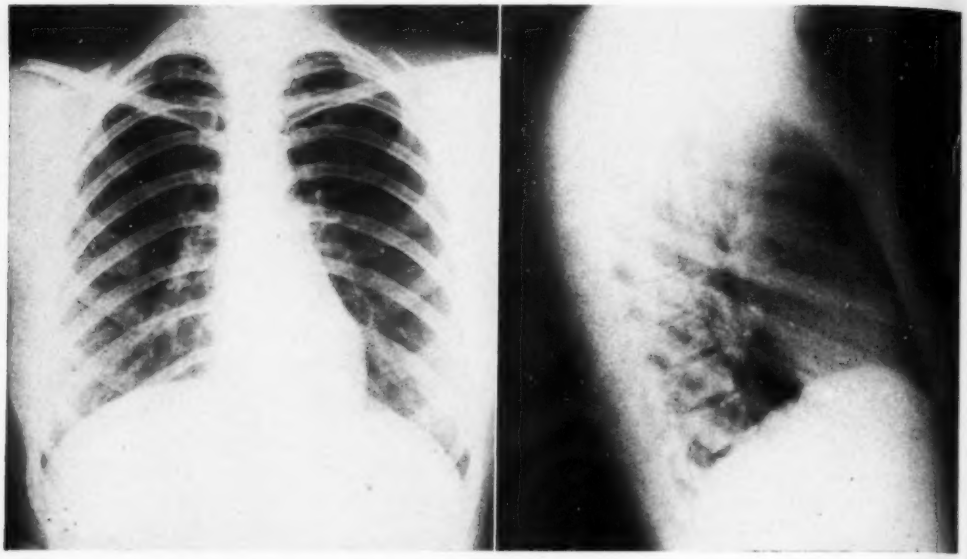

Fig. 2. Case 2: R. N., white female, 21 years, nurse. Roentgenograms made in June 1946, a month after discovery of the lesion on a routine chest film. A large nodule is demonstrable. The lateral film shows the lesion to be in the subapical portion of the right lower lobe

the transverse appearance of these lines that we wish particularly to emphasize.

In the lateral view, when the lesion is in the lower lobe apex, the infiltration is well posterior, near the posterior chest wall. It appears lower and more anterior when in the subapical portion. Very small lesions may be difficult or impossible to demonstrate in this projection.

Fluid is apt to form early. As the disease progresses, nodular or patchy confluent areas appear. There is frequently early cavitation. Later, spread to the rest of the lobe occurs, either in the form of infiltrating streaks, which may also have the transverse appearance, or as a massive consolidation. Finally, there is spread to the rest of the lungs.

DIFFERENTIAL DIAGNOSIS

There are many conditions which must be distinguished from lower-lobe tuberculosis. Our discussion of these will be only from the point of view of roentgen diagnosis. Obviously the final proof rests with the laboratory and the demonstration of the tubercle bacillus or other etiologic agent. The clinical history and physical examination are equally important.

1. Normal Lung Markings: In the very early case differentiation from normal lung markings is the most difficult problem. The shadows of the early infiltration of lower-lobe tuberculosis, however, are more transverse and extend transversely toward the periphery, rather than fanning out radially as do the bronchovascular markings. The lines also have a fine nodular or beaded appearance, which differs from that of the vascular shadows. Comparison with the opposite side is usually of help in differentiation.

2. Bronchopneumonia and Bronchiectasis: In bronchopneumonia and bronchiectasis the shadows extend in a downward and outward direction toward the diaphragm rather than transversely. They are not as fine or beaded in appearance, and there is less involvement toward the periphery. Fungus infection and atypical pneumonia may also present problems in differential diagnosis, but these again do not show the characteristic transverse lines.

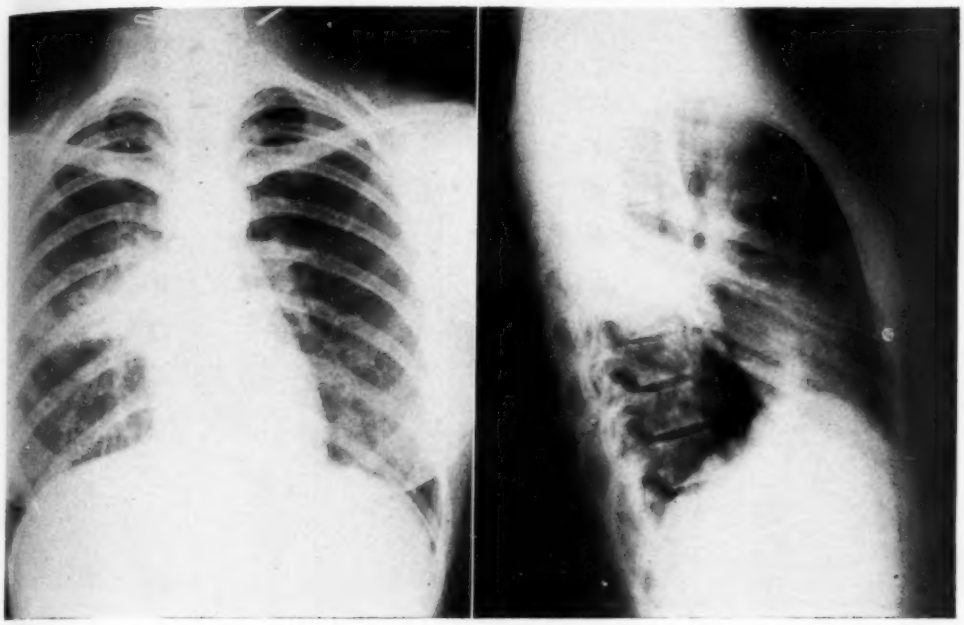

Fig. 3. Case 3: E. W., white female, 20 years, nurse. Films obtained one month after onset, showing broad infiltration from the hilus transversely to the periphery on the right. In the lateral view the involvement is seen to be in the apex of the right lower lobe.

3. Non-tuberculous Lung Abscess: In the presence of a non-tuberculous abscess there is usually more pulmonary reaction surrounding the cavity. In the tuberculous form the transverse markings again may be helpful. Sputum studies are, of course, conclusive.

4. Cancer: The lymphatic permeation type of early metastatic cancer may be difficult to distinguish from lower-lobe tuberculosis. Segmental emphysema or atelectasis is usually associated with a primary neoplasm.

CASE REPORTS

CASE 1 (Fig. 1): C. W., white female, 20 years of age, a nurse. The onset of symptoms was in June 1942, with fatigue and loss of weight. Roentgenograms at that time showed the typical transverse infiltration in the subapical portion of the left lower lobe. Pneumothorax was unsuccessful and treatment was by bed rest. In January 1944, cavitation developed in the lesion. Repeated phrenicolyses were done. In 1946 and 1947 the sputum was still occasionally positive. The lower lobe lesion was almost entirely healed in 1947, but there was spread to the upper lobe, with a small lesion in the left first interspace.

CASE 2 (Fig. 2): R. N., white female, 21 years of age, a nurse. The lesion was first found on a routine film, which showed a transverse infiltration in the outer portion of the right third interspace. On questioning, the patient said she had noticed a slight weight loss and increased fatigability. She was treated conservatively, and by July 1947 there were only a few dense strands at the site of the earlier lesion.

CASE 3 (Fig. 3): E. W., a white female, 20 years of age, a nurse. The onset was in May 1946, with cough and chest pain. A film about four weeks later showed marked involvement of the apex of the right lower lobe. The sputum was positive for the tubercle bacillus. Therapeutic pneumothorax was performed after a large hemoptysis in July. The patient is now back at work with pneumothorax and a negative sputum.

CASE 4: J. L., white female, 20 years of age, a nurse. This patient had no clinical signs or symptoms of tuberculosis. A nodular lesion in the periphery of the right lower lobe with fine transverse infiltrations extending medially was found on a routine chest film in 1946. The patient has remained well and there has been no change demonstrable roentgenographically since that time.

CASE 5: L. F., colored female, 26 years of age, first admitted in December 1945 with a history of cough, weakness, and loss of weight for three months. For one week she had pleural pain, chills, and hemop-

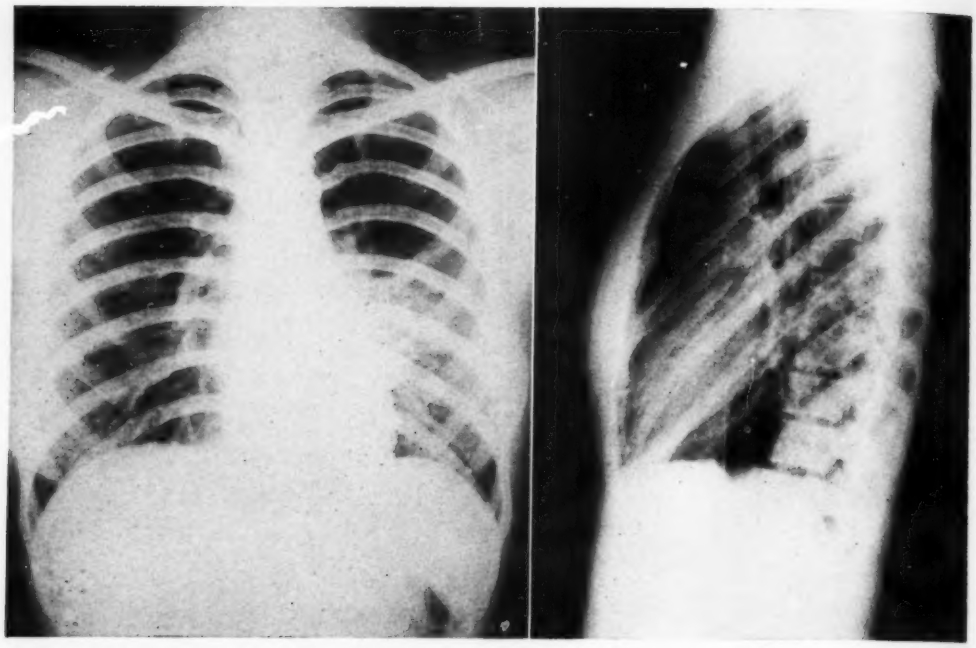

Fig. 4. Case 6: L. D., colored female, 19 years. Soft transverse infiltration from left hilus, extending toward the periphery. The lateral view shows the lesion far posterior, in the apex of the lower lobe.

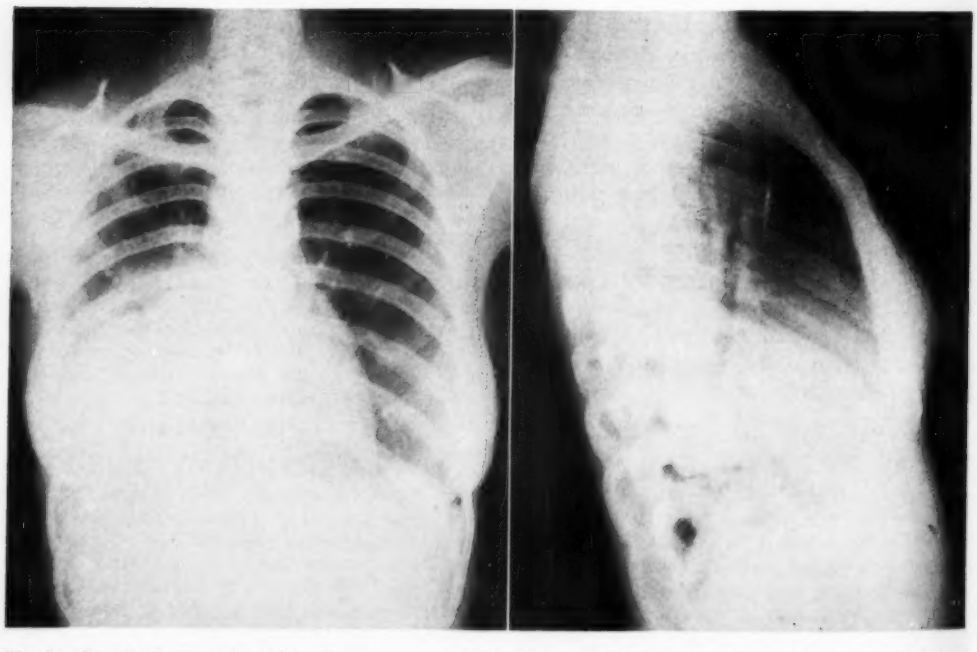

Fig 5. Case 9: L. R., colored female, 18 years. Late lesion. Consolidation of right middle lobe and infiltration in right lower lobe, with cavitation. The disease progressed rapidly and the patient died.

tysis. X-ray examination at that time showed fluid at the right base and infiltration in the right lower lobe. The sputum was positive for tuberculosis. The disease appeared stationary for some time, and in July 1946 the patient gave birth to a normal child. In 1947 spread to the left lung occurred, with cavity formation, and the disease is now far advanced.

CASE 6 (Fig. 4): L. D., colored female, 19 years of age, admitted in October 1934 with a history of cough, loss of weight, and slight hemoptysis for about two months. The onset had been acute. Roentgen examination showed infiltration through the upper portion of the left lower lobe. The sputum was positive. Unfortunately this patient could not be followed.

CASE 7: T. S., colored female, 18 years of age, with a history of right lower quadrant abdominal pain and 22 pounds weight loss in four months. Clinical and roentgen findings were typical of ileocecal tuberculosis. A chest film showed the characteristic transverse infiltration in the left lower lobe. The sputum was repeatedly negative for the tubercle bacillus.

CASE 8: S. H., colored female, 26 years of age, first admitted in May 1942, complaining of cough and pain in the left side of the chest for one month, occasional night sweats, and one hemoptysis a week before admission. A roentgenogram showed extensive consolidation of the lower portion of the left lower lobe and soft transverse infiltration in the upper portion of the lobe. The sputum was positive. A therapeutic pneumothorax was done, and the patient was discharged to a sanatorium. In December 1942 she was readmitted with spread to the right side and she died shortly thereafter.

CASE 9 (Fig. 5): L. R., colored female, 18 years of age, admitted in September 1942. The onset of her illness was three months before admission, with cough, expectoration, occasional fever, and a persistent "cold." Later there were fatigue and weight loss. Roentgen examination on admission showed consolidation of the right middle and part of the lower lobe, with a cavity in the apex of the lower lobe. The sputum was positive. The course was rapidly downhill, with a high fever, and death ensued in December 1942.

CASE 10 (Fig. 6): R. W., white female, 68 years of age, admitted Sept. 3, 1945. The history was not very satisfactory because of language difficulty. The patient complained of pain in the left side of the chest following a fall four days before. Roentgen examination showed a bilateral lower-lobe infiltration which was thought to be on the basis of bronchopneumonia. The Wassermann reaction of the blood was positive. The patient died on Sept. 22, 1935. Autopsy revealed bilateral tuberculous pneumonia of the lower lobes. There was a large left pleural effusion.

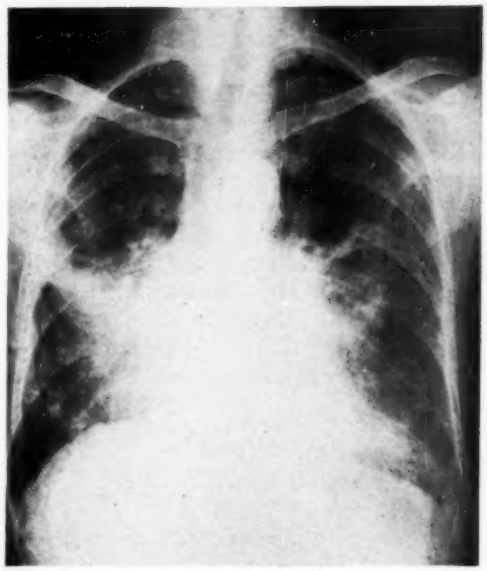

Fig. 6. Case 10: R. W., white female, 67 years. Bilateral lesions extending from the hili transversely to the periphery. There is also heavy infiltration downward toward the diaphragm. This was thought to be bronchopneumonia. Autopsy showed bilateral lower lobe tuberculosis.

CONCLUSIONS

1. Pulmonary tuberculosis originating in the lower lobe is generally considered uncommon because (*a*) most cases are discovered late, when spread to the rest of the lungs has already occurred, and (*b*) the midlung or "perihilar" infiltration is not recognized as actually lying in the upper portion of the lower lobe. If the disease were discovered earlier and a film taken in the lateral position, the reported incidence would be markedly increased.

2. Ten cases of lower-lobe tuberculosis have been reported here. While this series is not suitable for statistical analysis, it shows, like those of previous investigators, that this disease occurs predominantly in young women. The extraordinarily high incidence in nurses, reported by others, is also confirmed.

3. The most frequent site of the early lesion is in the apex or subapex of the lower lobe. On the routine chest film this

produces characteristic transverse lines of infiltration which extend from the hilus toward the periphery or may be limited to the middle or peripheral portion of the lung at or just below the level of the hilus. The transverse position of these lines, as well as their beaded or finely nodular appearance, make it possible in many cases to distinguish them from normal bronchovascular markings and other infiltrative processes. It is at this stage that the diagnosis should be made and confirmation sought from clinician and pathologist, before massive consolidation, cavitation, and spread have occurred.

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SUMARIO

Reconocimiento Roentgenológico Temprano de la Tuberculosis del Lóbulo Inferior

La tuberculosis pulmonar originada en el lóbulo inferior pasa generalmente por ser rara porque: (1) la mayor parte de los casos se descubren tardíamente, cuando ya ha ocurrido la difusión al resto de los pulmones, y (2) no se reconoce que la infiltración mesopulmonar o "perihiliar" queda realmente en la porción superior del lóbulo inferior. Si se descubriera la afección antes y se tomara una radiografía en la posición lateral, la incidencia descrita acrecentaría considerablemente.

En este trabajo comunícanse 10 casos de tuberculosis del lóbulo inferior. Aunque la serie no se presta para análisis estadístico, demuestra, lo mismo que las series de previos investigadores, que la enfermedad predomina en las mujeres jóvenes. Confírmase también la extraordinaria incidencia, ya mencionada por otros, en las enfermeras.

El asiento más frecuente de la lesión temprana es en el vértice o subvértice del lóbulo inferior. En la radiografía torácica corriente esto produce típicas líneas transversales que se extienden del hilio hacia la periferia o pueden limitarse a la porción media o periférica del pulmón en el hilio o precisamente más abajo del mismo. La posición transversal de dichas líneas, así como su aspecto moniliforme o finamente nodular, permite en muchos casos distinguirlas de las marcas broncovasculares normales y de otros procesos infiltrantes. En este período es que debe hacerse el diagnóstico y buscarse confirmación de parte del clínico y del patólogo, antes de que se presenten hepatización masiva, cavitación y difusión.

Contrast Enema in Lateral Recumbency; Aimed Gas Filling of the Colon[1]

DR. FRANCIS POLGAR

THE TECHNIC OF the barium enema study has undergone little change since its introduction by Haenisch in 1911. It has usually been carried out with the patient supine or—especially for observations on the pelvic colon—prone, the roentgen rays being directed vertically. This arrangement is uncomfortable both for the patient and the roentgenologist. The former must lie for a long time on the hard fluoroscopic table; the latter has to make the prolonged examination in a tiring position, standing and leaning forward over the table.

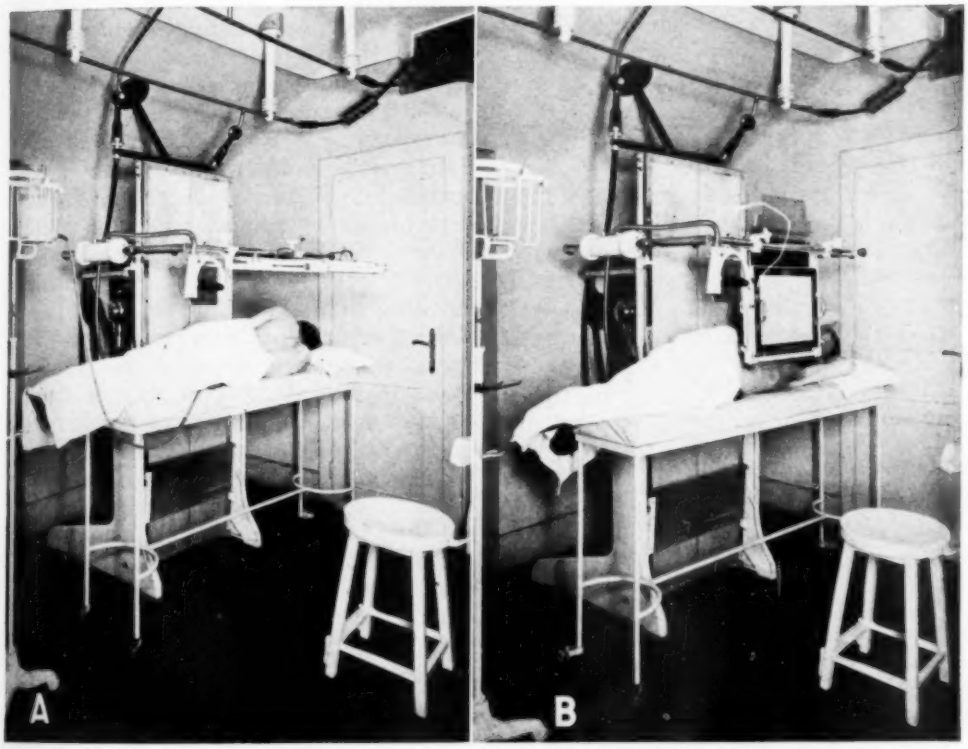

Fig. 1. A. First stage of the barium enema study in lateral recumbency. The screen is raised at an angle of 90° in order to facilitate manipulation of the patient. B. Second stage of the examination, after complete filling of the colon.

For two years we departed from this classical method,[2] making the examination with the patient in lateral recumbency—that is, the usual position for a cleansing enema—with the x-ray beam directed horizontally. The patient lies on a stretcher,

[1] Accepted for publication in March 1948.

[2] The following report, submitted from the *Home d' études pour refugies intellectuels*, Geneva, Switzerland, refers to examinations made by the author as chief of the Department of Roentgenology of Szeretetkorhaz in Budapest during the years 1942–43. Since 1944 he has been prevented by world circumstances from publishing his results and pursuing the investigations to be described here; hence the relatively small number of illustrative cases.

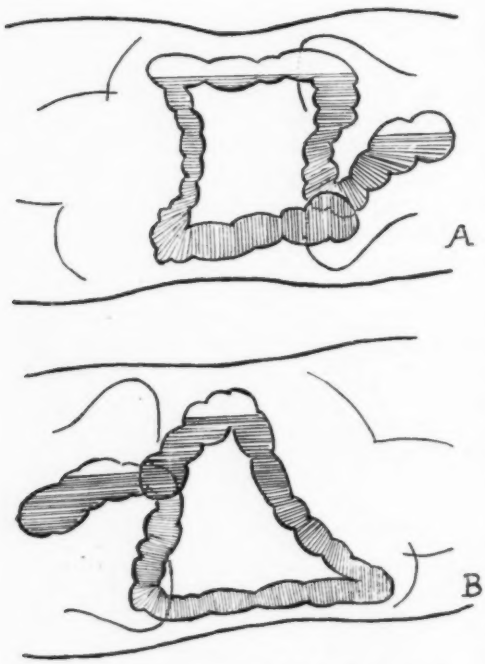

Fig. 2. Schematic drawing illustrating the topography of the normal colon in right (A) and left (B) lateral recumbency.

some 42 cm. in width, padded with rubber cushions. If this is so constructed that either end may be raised or lowered, an additional advantage is obtained. The fluoroscope is equipped with a device so that the x-ray tube can be moved back a distance of 1.5 meters from the screen, without being detached (principle of the "optic bench"). Thus it becomes possible to take what we have designated as "aimed teleroentgenograms"—an important advantage over the examination as usually carried out on the fluoroscopic table.

The filling of the intestine is begun with the patient on the right side (Fig. 1A), his back turned toward the screen (anteroposterior view), and he remains in this position until the opaque medium reaches the splenic flexure, the highest point in the colon. He then turns, and filling of the transverse and right colon follows in left lateral recumbency (Fig. 1B) with the rays directed postero-anteriorly. In either position the necessary palpation and compression can be employed with or without the use of a pressure cone or other device, and spot films can be taken.

In lateral recumbency the roentgenologic aspect of the large intestine differs from the usual picture seen in the erect, prone, or supine position. This is the result of changes of visceral topography due to the action of gravity (2). The hemidiaphragm on the side on which the patient lies assumes a high position, and the opposite leaf sinks to a low level. The cephalocaudal length of the now "lower" half of the abdomen is increased, and the corresponding vertical part of the colon elongates like an accordion. In left lateral recumbency the descending colon and the sigmoid are lengthened and the splenic flexure ascends behind the lower ribs (Fig. 2B). Simultaneously the cecum, being movable in the majority of cases, may sink on account of its own weight medialward, reaching or passing the midline. Occasionally a fluid level appears in the topmost part of the colon, *i.e.*, the ascending colon in this position. With the patient on his right side, the ascending colon elongates and the descending colon shortens (Fig. 2A), the gas content ascends into the high-situated left-sided parts, and the heavy opaque fluid passes downward to fill out the cecum and the ascending colon to its full extent.

Both in the right and left lateral recumbent positions, fluid levels commonly appear in the uppermost parts of the colon, varying in extent according to the amount of free gas and fluid present. The roentgen appearance of the large intestine with the patient on his side thus differs from the usual picture, which at first seems oddly changed. However, it must be remembered that, whatever the patient's position, fluid levels always exist in the fluid-filled colon, though they are invisible when the contrast enema is administered in the usual fashion on the fluoroscopic table. In the supine position the gas bubbles are adjacent to the ventral intestinal wall, and

their shadow of negative density is obscured by that of the barium collecting in the dorsal outpouchings of the wall. Gas always rises into the highest parts of the colon, with the exception of the convoluted loops (*e.g.*, the normal sigmoid), where a "siphon-effect" may hinder its free migration. The most common example of this stratification is seen on examination of the patient in the upright posture after filling of the colon with a barium clysma: fluid levels then appear, as a rule, in the hepatic and splenic flexures. However, there is nothing to prevent bringing every part of the wall of the colon into contact with the opaque material by rotating the patient in different positions, a procedure just as practicable with him lying on his side as upon the fluoroscopic table. Besides, gases are just as valuable contrast substances as opaque materials and are generally used in the double contrast method. Moreover, the ascent of the gas into the lateral parts of the colon affords entirely new possibilities for the roentgen study of intraluminal lesions (see below).

The contrast enema is well tolerated in the lateral recumbent position. The fluid passes the rectosigmoid junction in a short time without overdistending the ampulla and thus causing a defecation reflex, as frequently occurs in the supine position (though not in the prone). A further advantage of the new method consists in the perfect protection of the examiner from direct and scattered x-rays and, finally, in the fact that he remains seated while conducting the examination.

It must be emphasized, however, that examination in lateral recumbency cannot fully replace the classical method of Haenisch. In certain cases the patient is too weak to maintain his balance on the narrow couch. For some obese patients the fluoroscopic table is to be preferred because of the diminution of the anteroposterior diameter of the abdomen in the prone or supine position. Nevertheless, the lateral recumbent position has such valuable advantages, that it became—in our practice—the routine procedure, and the old method was used only exceptionally.

To summarize, the advantages of lateral recumbency are:

(1) The position is more comfortable for the patient.

(2) The examination is less tiresome for the physician.

(3) The examiner is perfectly protected against damage by x-rays.

(4) The examination may be performed without a fluoroscopic table.

(5) Spot and survey films may be taken from a great focal distance.

"AIMED GAS-FILLING" OF THE COLON

Since Fischer's (1) first description (1925), the double contrast enema has become one of the well established methods of investigation of the large intestine, though it is still not so widely used as its value would warrant, due probably to the inconveniences and difficulties of the original technic. By combining gas-filling of the colon with the enema examination in lateral recumbency, these difficulties can readily be overcome.

According to the technic employed by Fischer, the opaque enema is given with the patient on the fluoroscopic table. Subsequently he must be transferred to a stretcher placed before the vertical fluoroscope, where the supplementary insufflation is done, under the guidance of horizontally directed rays. This interrupts the course of the examination and as a rule requires the help of nursing personnel. If, in changing his position, the patient gets to his feet, he frequently feels the need of moving his bowels. A further difficulty consists in the fact that a complete filling of the colon with fluid and gases may over-expand the caliber of the intestine, entailing the possible risk of perforation in the presence of ulcerous lesions.

These difficulties are eliminated by examination in lateral recumbency, which with adequate equipment is a very simple procedure. Unfortunately most types of standard vertical fluoroscope are without the necessary supplementary device for

examination of the patient lying on his side. The attachment of a shelf to the fluoroscope for this purpose is impracticable; only a rolling stretcher meets the requirements. Such a stretcher should be constantly at hand in the fluoroscopy room, for the manifold advantages of fluoroscopic examination in lateral recumbency can be fully utilized only where it is possible to include it in the daily routine without loss of time.

Fluoroscopy in lateral recumbency makes it possible to combine both phases of the double contrast enema study in a single process without moving the patient. For the filling of the bowel with gas, this method takes advantage of the familiar observation that gas bubbles gather in the uppermost part of the colon. The gas content of the large bowel is displaced by peristalsis as well as by static forces which cause it to rise to the topmost part. Thus the sites of gas accumulation are, with the patient upright, the hepatic and splenic flexures and the upper part of the sigmoid; in right lateral recumbency the descending colon and the first segment of the sigmoid; in left lateral recumbency, the cecum, ascending colon, and hepatic flexure; in the supine position, the middle portion of the transverse colon; and finally, with the patient prone, both vertical parts of the colon.

If, for example, the splenic flexure is filled by a large amount of gas and the patient is turned on his left side, localized meteorism of the cecum and ascending colon develops within one or two minutes. Observing the migration of the bubbles during an insufflation, one sees that only rarely does a valve-like obstruction hinder their rising. In such cases, free passage can, as a rule, easily be attained by changing the position of the patient or increasing the gas pressure. The air-filling of certain parts may be increased by elevating the chest or the pelvis with sand bags or pillows. With these considerations in mind, one can make use of the advantages of the double contrast enema in lateral recumbency in studying disorders of the cecum, ascending colon, hepatic and splenic flexures, descending colon, and first segment of the sigmoid. As is well known, these portions of the colon are the ones most commonly involved by pathological changes. By taking advantage of changes in position, we can inflate a small circumscribed portion of the colon, either by means of a double contrast enema or, without the administration of barium, by means of a simple "negative contrast filling." A small amount of air suffices for this purpose when injected with the patient in a position appropriate for securing the ascent of gases into the parts of the bowel actually concerned. It is appropriate, therefore, that this method of investigation be called "aimed gas-filling" of the colon. The insufflation of circumscribed segments is generally done immediately after the barium enema, which should be as small in amount as possible. In some cases, as suggested above, "aimed air-filling" alone, without the use of opaque substance, can yield sufficient information for a correct diagnosis.

Reviewing the illustrations of Fischer's paper, it becomes evident that roentgenograms taken with the original technic are poor in detail. They are for the most part survey pictures of the colon, and the lack of clearness compels the author to explain them by illustrative drawings. In contrast to this, the "aimed gas-filling" method makes it possible to take "aimed teleroentgenograms" of small selected parts of the colon. The use of a secondary diaphragm is unnecessary, permitting the employment of a low voltage, whereby one may obtain films rich in detail, particularly of the soft parts. Even the thickness of the intestinal wall can sometimes be clearly demonstrated (Fig. 4, B and C), in striking contrast to films taken with a Potter-Bucky grid. The following cases illustrate various disorders of the flank parts of the colon examined by "aimed gas-filling."

CASE REPORTS

CASE I: A 69-year-old doctor, of stout body build, was admitted because of slight discomfort in

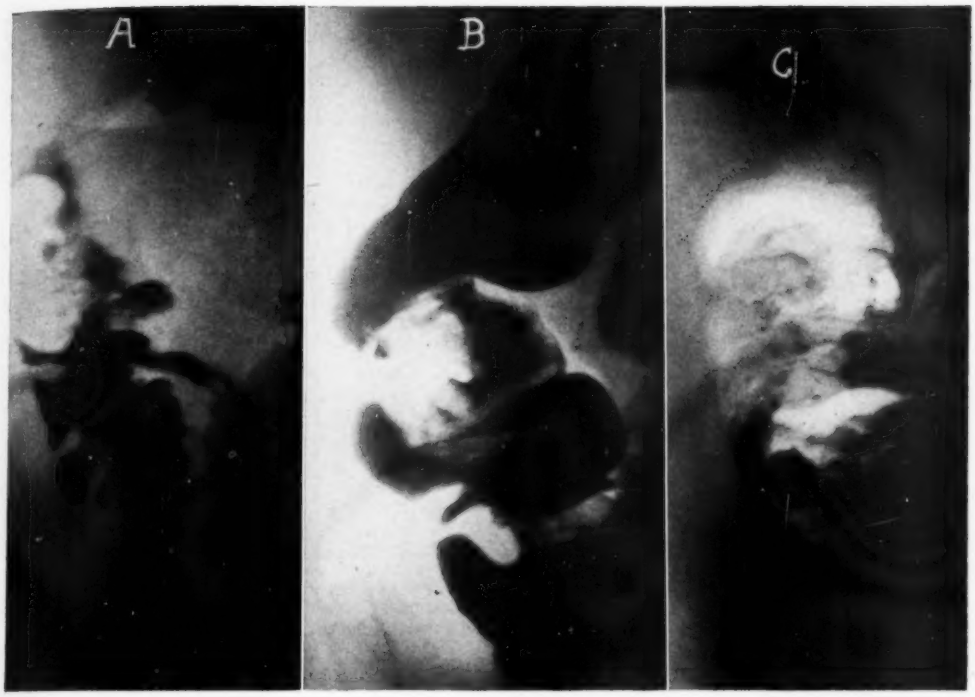

Fig. 3. Case I: Polypoid cancer of the ascending colon.
A. Film at six hours after a barium meal, showing a large ovoid defect in the distal half of the ascending colon.
B. Film taken in lateral recumbency after the administration of a contrast enema.
C. "Aimed gas-filling" of the ascending colon in left lateral recumbency, demonstrating the intraluminal soft-tissue shadow of the tumor.

the right half of the abdomen, of four months duration, and occasional attacks of abdominal distention. One of his brothers had died of cancer of the colon. No tenderness was present and no mass could be felt.

A contrast enema in lateral recumbency (Fig. 3B) disclosed a sharply defined defect the size of a hen's egg in the ascending colon, immediately below the right flexure and adjacent to the lateral wall. This finding was confirmed by a barium meal study (Fig. 3A).

"Aimed gas-filling" in left lateral recumbency, performed in this case (our first) in addition to the barium meal examination showed the tumor distinctly (Fig. 3C), as a positive soft-tissue shadow surrounded by the radiolucent air-filled area. Its surface was irregular and its base merged in the lateral intestinal wall.

At operation a tumor was found in the ascending colon, and ileocolectomy was performed. The tumor measured 8 × 5 cm., with thick elevated margins and a necrotic crater in its center. Macroscopically it was of a polypoid type. The microscopic diagnosis was carcinoma solidum.

CASE II: A 25-year-old woman was admitted because of cramping abdominal pains of four weeks duration, experienced often during defecation. For three years she had had a "catarrh of the apices." During the night she sometimes suffered from nausea and epigastric pain. She had lost 9 pounds in weight. Examination revealed tenderness in the right iliac fossa and a palpable mass the size of a hen's egg, suggestive of a movable kidney.

Roentgen examination of the thorax showed both upper lung fields riddled with small foci of medium density (hematogenous dissemination). A contrast enema study (by the method of Haenisch) demonstrated (Fig. 4A) a laterally situated, sharply defined defect in the proximal part of the ascending colon. This defect coincided with the palpable mass. The medial wall of the involved bowel showed small indentations. A double-contrast enema examination in left lateral recumbency (Fig. 4B) showed an intraluminal soft-tissue shadow corresponding to the site of the defect and attached by a broad base to the lateral wall. Orally from this a small flat projection of the wall can be observed; this corresponds to a slight concavity in the barium film, in which, however, it could not be recognized as a pathological change. In the lower part of the cecum a third soft-tissue shadow filled the lumen, crossing it transversely. Two days later "aimed gas-filling" of the cecum and ascending colon was performed in

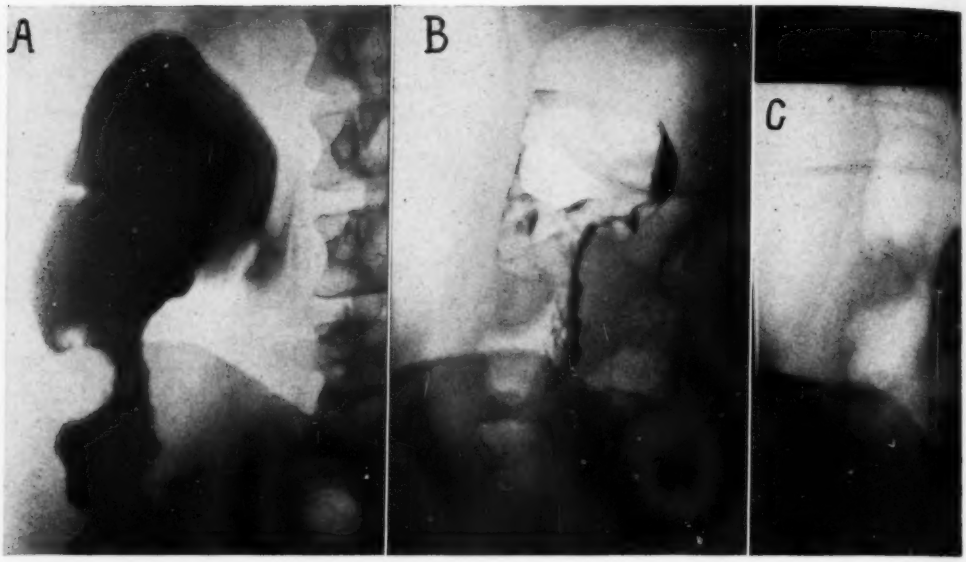

Fig. 4. Case II: Hyperplastic tuberculosis of the cecum and ascending colon.
A. Film taken in the supine position after a contrast enema, showing a sharply defined defect adjacent to the lateral wall of the colon and wavy margins of the wall opposite the defect.
B. Double contrast enema in left lateral recumbency. Orally from the large tumor shadow a small inward projection of the lateral wall is seen. A third soft-tissue shadow, crossing the lumen transversely, is present in the cecum.
C. "Aimed gas-filling" of the right colon in left lateral recumbency. Three intraluminal soft-tissue shadows are discernible. Note the clear details of the soft-tissue structures in the teleroentgenograms B and C (taken without Potter-Bucky grid).

left lateral recumbency without barium (Fig. 4C). The film shows a marked richness in soft-tissue detail. Between the properitoneal layer of fat and the gas shadows of the colon, the intestinal wall itself casts a shadow. This latter shows, corresponding to the three soft-tissue shadows in Figure 4B, three projections with the convexity inward, in contrast to the outward convex outlines of the undamaged wall. The uppermost tumor is not pedunculated, but attached to the mucous surface by a broad base, a detail indistinguishable in the barium film. These findings established the roentgen diagnosis of hyperplastic cecal tuberculosis.

An ileocolectomy was done and the diagnosis of tuberculosis of the colon, of hyperplastic ulcerous type, was thus established.

CASE III: A 60-year-old obese man was admitted because of abdominal distention and pains in the left half of the abdomen of six weeks duration. Occasionally he felt the movement of the bowels coming to a sudden stop, with additional cramps. He had passed one tarry stool. No palpable mass could be felt.

At the barium meal examination a constriction 8 cm. in length was found in the distal part of the descending colon. The defect showed irregular margins; anally from it a localized gas shadow contrasted with a soft-tissue shadow representing the distal pole of a tumor. A contrast enema demonstrated analogous changes. "Aimed gas-filling" in right lateral recumbency showed ample distention of the lumen both above and below the narrowed portion. Both the upper and lower poles of the tumor were clearly visible as soft-tissue shadows within the surrounding mantle of air. The film displayed circular thickening and retraction of the intestinal wall revealed by the concavity of its lateral margin. These signs undoubtedly indicated the presence of a cirrhotic tumor of the "napkin-ring" type. During the inflation, the patient complained of pains similar to those he felt while emptying the bowels. His cramps were thus due to distention and not to spasm.

At operation, a circular cirrhotic tumor, 10 cm. in length, was removed by thermocauterization. Microscopic examination disclosed an adenocarcinoma.

CASE IV: A 59-year-old man was admitted because of cramping pains in the left half of the abdomen, of eight months duration. A stone was found in the left kidney and, for a time, the complaints were thought to be due to this. Later a roentgen examination of the gastro-intestinal tract was requested on account of failing strength and a loss of 5 pounds in weight.

During administration of the contrast enema in right lateral recumbency, the normal gas-content of the colon rose into the descending colon and brought into contrast several roundish soft-tissue shadows

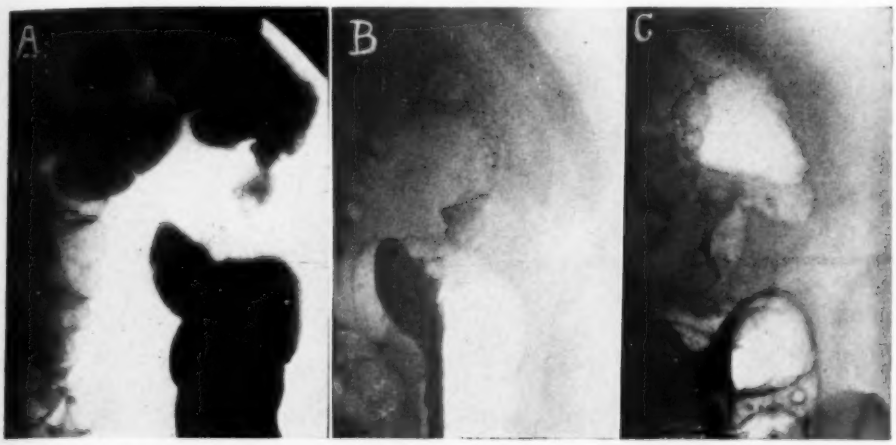

Fig. 5. Case V: Tumor of the descending colon with central necrosis.
A. Film taken on the fluoroscopic table with Potter-Bucky grid. B and C. Teleroentgenograms without Potter-Bucky grid.
The contrast enema (A) disclosed a long constriction in the middle part of the descending colon, with irregular margins and a large central cavity. At the beginning of air insufflation (B) the segment of the large intestine anally from the narrowed part became distended. When more air was injected (C), it passed through the constricted lumen and made the whole tumor visible between the gas-distended loops. The central enlargement of the canal is filled out by air and its medial wedge-shaped prominence suggests the presence of a necrotic crater.

projecting into the lumen. When the amount of barium and gas was increased, these structures appeared to be attached to the medial intestinal wall, the contour of which was interrupted. The length and the superior pole of the intraluminal mass could readily be observed. Complete air-distention of the left colon showed a funnel-shaped constriction of the involved part with the narrow end directed toward the gas-filled sigmoid.

At operation, the distal part of the descending colon was resected. It contained a tumor 10 cm. in length, adherent to the lateral abdominal wall and invading the mesosigmoid. The pathologic diagnosis was cancer of the mucocellular type with partial obstruction of the bowel lumen.

CASE V: A 55-year-old obese man was submitted to roentgen examination of the gastrointestinal tract because of slight left upper quadrant pain of one years duration and increasing constipation. In the month previous to examination his bowels moved only when he took a laxative. No palpable mass could be felt. The blood sedimentation rate was 24 mm./hr.

The inflow of the contrast enema was halted in the proximal part of the descending colon (Fig. 5A). An irregular constriction, 7 cm. in length, was then outlined, showing ragged contours and a central cavity the size of a plum. When "aimed air-filling" was done with the patient in right lateral recumbency (Fig. 5B), the gas was temporarily stopped at the distal pole of the defect. With increased pressure (Fig. 5C), air passed through the constricted part and, accumulating beyond it, allowed the superior pole of a soft tumor shadow to be seen clearly in the radiolucent area. Between the normal portions of the colon, distended with air, the size and shape of the tumor were well demonstrated. A wedge-shaped prominence of the air-filled central cavity was suggestive of a necrotic crater. The patient declined operation, and no further information was available.

Cases may be observed in which the injected air cannot be forced through the narrowed lumen, even by increasing the pressure of gas, in consequence of a valve-like obstruction. The method of "aimed gas-filling" has thus its limits like any other diagnostic procedure.

CASE VI: A 64-year-old man was admitted because of cramping postprandial pain, of six months duration. There had been progressive weight loss, and intestinal hemorrhages had occurred several times.

The opaque enema showed a narrowed and deformed segment, the length of the little finger, with ragged contours, at the junction of descending colon and sigmoid. During "aimed gas-filling" in right lateral recumbency, the proximal sigmoid became over-inflated, but no gas passed through the constricted lumen.

At operation a tumor 8 cm. in length was resected and found to be an adenocarcinoma. Some weeks later the patient had diarrhea and lost weight rapidly. These symptoms were suggestive of an

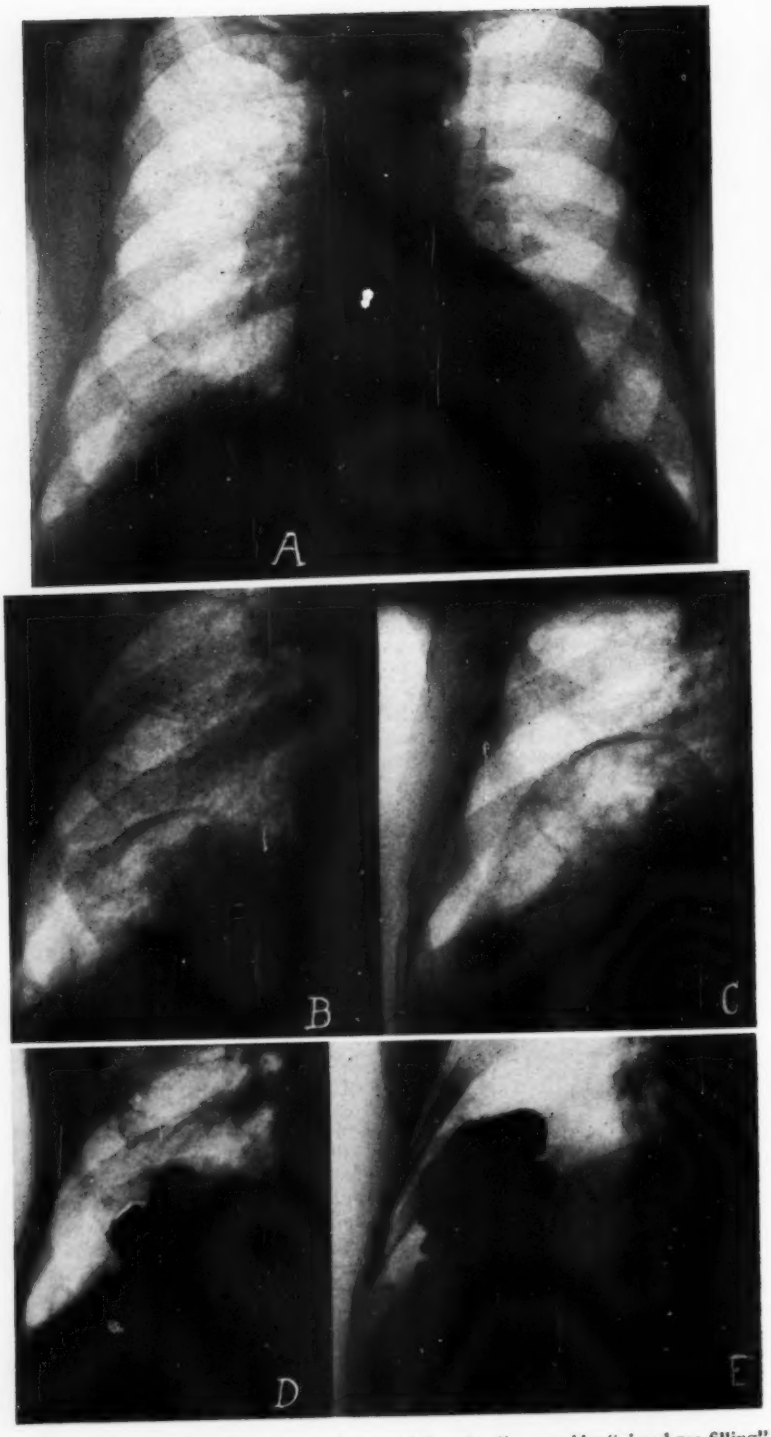

Fig. 6. Case VII: Right-sided diaphragmatic hernia, diagnosed by "aimed gas-filling" of the colon. (*Legend continued at foot of opposite page*)

ileocolic fistula, the presence of which could readily be demonstrated by means of "aimed gas-filling." The film taken in right lateral recumbency showed the well distended sigmoid and, at its superior pole, a round extraradiolucent area communicating with the ileum. The roentgen diagnosis of an ileocolic fistula was confirmed at reoperation.

CASE VII: Fluoroscopy of the thorax of a 70-year-old man showed a large half-spheroid projection of medium density, arising from the right hemidiaphragm. The respiratory movements of this portion were restricted and in the basal part a small strip of calcareous density could be seen (Fig. 6A). The patient had no complaints referable to the thoracic organs; twenty years previously he had had pleurisy.

Since the pathological shadow was suggestive of right-sided diaphragmatic hernia, "aimed gas-filling" of the large intestine was done in left lateral recumbency. Our assumption was verified almost at once, for the injected air rose instantly to the topmost part of the colon, in this position the hepatic flexure, enclosed in a hernial sac. In lateral recumbency (Fig. 6B) the right wall of the hernia became more distended by gas pressure and in the upright position (Fig. 6C) the cephalic wall. The diagnosis was confirmed by the barium enema study (Fig. 6, D and E), which, however, yielded no more information as to the roentgen symptomatology of the disorder than did air-filling.

This case, in addition to Case II (Fig. 4) emphatically proves that the contrast enema can be replaced in certain conditions by "aimed gas-filling" of the large intestine. The advantages of this simple, cheap, quick, and clean procedure over the enema are easily comprehensible.

COMMENT

The above cases illustrate merely the first steps taken on a new and promising road. The method of "aimed gas-filling" developed, step by step, during daily practice. When we started barium administration in lateral recumbency, we did not know that we would combine with it the injection of air. When realizing (for the first time, so far as I know) the direct visualization of intraluminal neoplasms of the colon, we did not know that the correct diagnosis of a fistula or a hernia could also be established in this way. Nor can we know at present what results will be attainable in the diagnosis of other disorders, such as intussusception, polyposis, diverticula, etc. However, the above experiences entitle us to recommend barium enema studies in lateral recumbency, either as a separate method or in combination with "aimed gas-filling" of the large intestine, as a routine procedure to be introduced into everyday practice.

SUMMARY

A new technic for contrast enema studies of the large bowel is here elaborated, consisting in the placement of the patient in the laterally recumbent position and the use of the vertical fluoroscope with horizontally directed rays. It is possible thus to unite both phases of the double contrast method in a single operation, with the patient resting upon the same examination table during the whole procedure.

This new method is especially indicated in the investigation of disorders of the ascending and descending colon. By suitable positioning of the patient, isolated gas-filling of circumscribed segments of the colon can be carried out; this we have termed "aimed gas-filling" of the colon. It may be employed even without the administration of barium as a negative contrast method. Optimal results are obtained thereby when taking teleroentgenograms without the use of a secondary diaphragm.

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A half-spheroid projection of the right hemidiaphragm (A) was suggestive of diaphragmatic hernia. "Aimed gas-filling" of the colon in left lateral recumbency (B) showed gas-distended loops of the large bowel within the abnormal shadow. The lateral wall of the hernial sac projects toward the chest wall. In the upright position (C) the sac appeared more distended, showing a semicircular contour. The diagnosis was confirmed by films following a barium enema in the upright (D) and right lateral recumbent (E) positions.

SUMARIO

El Enema de Contraste en Decúbito Lateral. La "Insuflación Asestada" del Colon

La nueva técnica aquí presentada está destinada a estudios con enemas de contraste del intestino grueso, consistiendo en la colocación del enfermo en decúbito lateral y en el empleo del fluoroscopio vertical con los rayos asestados horizontalmente. Resulta así posible unir en una sola operación las dos fases de la técnica de doble contraste, mientras el enfermo reposa durante todo el procedimiento en la misma mesa de exámenes. Simplifícase así el examen, resultando más cómodo tanto para el paciente como para el examinador y ahorrando tiempo.

Esta nueva técnica hállase indicada en particular en la investigación de los trastornos del colon ascendente y descendente. Colocando en posición apropriada al sujeto, pueden insuflarse con gas por separado segmentos circunscritos del colon, lo cual constituye la llamada "insuflación asestada" del colon, pudiendo emplearse hasta sin la administración de bario como técnica de contraste negativo. Los resultados son óptimos cuando se toman telerroentgenogramas sin emplear un diafragma secundario.

Osseous Changes in Erythroblastosis Fetalis[1]

WILLIAM L. JANUS, M.D., and M. WENDELL DIETZ, M.D.

TO THE ROENTGENOLOGIST, erythroblastosis fetalis represents a disease entity chiefly of obstetrical importance, in which his role as diagnostic consultant is quite limited. He realizes that, since the discovery of the Rh factor by Levine in 1941, a voluminous literature has accumulated concerning the clinical and laboratory aspects of the disease. Nevertheless, papers of radiological interest have been few and inconclusive. Admittedly, erythroblastosis does not consistently cause characteristic osseous changes comparable with other blood dyscrasias, such as Cooley's anemia or sickle-cell anemia, but the likelihood of encountering erythroblastosis is considerably greater, and roentgen manifestations undoubtedly occur. To clarify our present knowledge and to stimulate further investigation of this condition, we have selected for emphasis those findings of importance to the roentgenologist. In addition, we are presenting our analysis of x-ray studies of the largest collection of proved cases yet reported.

ETIOLOGY

Fifteen per cent (15 per cent) of white mothers lack the so-called Rh agglutinogen and are, therefore, termed Rh-negative. Sensitization of these mothers by the Rh-positive red blood cells of the fetus causes the formation of an anti-Rh agglutinin. Erythroblastosis develops because of the presence of this abnormal agglutinin in the serum of mothers of affected infants. Passage of this diffusible substance into the fetal circulation results in destruction of erythrocytes and the production of a typical clinicopathological syndrome.

CLINICAL AND LABORATORY ASPECTS

The physical findings in erythroblastosis fetalis are dependent upon excessive hemolysis with increased hematopoiesis. These basic changes result in jaundice, the most common sign; hepatic and splenic enlargement; petechiae, ecchymoses, and mucosal bleeding. Pigmentation of certain cerebral nuclei (kernicterus) may occur if the jaundice is intense. Universal edema or fetal hydrops is usually found only in those infants dying before or shortly after delivery. Laboratory findings include a macrocytic anemia, an increase in the number of nucleated red blood cells, leukocytosis, thrombocytopenia, and elevated icterus index.

REVIEW OF THE LITERATURE OF ROENTGENOLOGICAL INTEREST

Roentgen methods were utilized in the diagnosis of erythroblastosis for the first time by Hellman and Irving in antepartum studies (5). These authors described thickening and increased density of the fetal soft parts and a corona-like shadow surrounding the skull in maternal abdominal films. Such findings were present in three cases of the hydrops variety and were attributed to marked edema of the soft tissues. Particularly striking was the contrast afforded by the swelling of the scalp.

Later, Javert re-emphasized the halo effect around the skull (6). He also pointed out a Buddha-like habitus of the fetus; this bizarre position was produced by extension of the lower extremities due to soft-tissue edema. Abdominal distention, secondary to hepatosplenomegaly, caused an abnormal spinal curvature. Thus, prenatal radiological diagnosis has been limited to the small percentage of cases of the hydrops type. These invariably terminate fatally.

Changes in the long bones in erythroblastosis were first stressed by Caffey (1, 2). A heavy transverse line of increased

[1] From the Department of Radiology, The Johns Hopkins Hospital, Baltimore, Md. Accepted for publication in July 1948.

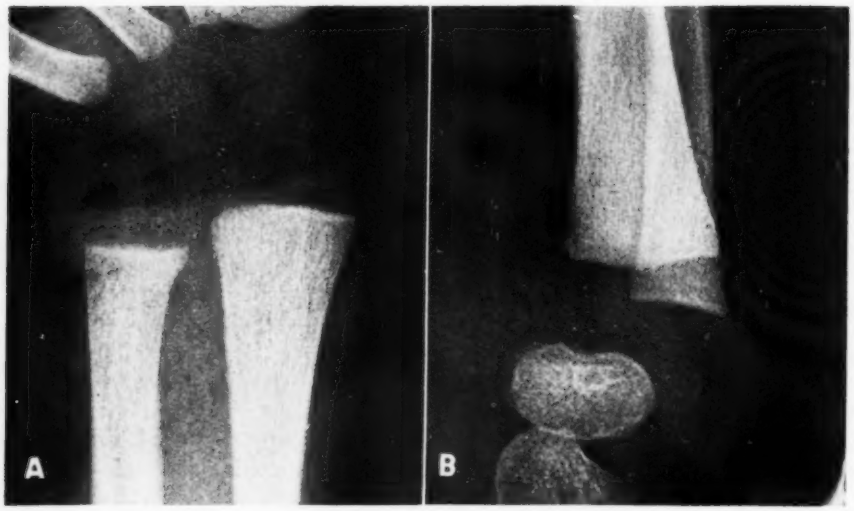

Fig. 1. Normal left wrist (A) and right ankle (B) in a healthy newborn infant. Note that the trabecular architecture extends to the epiphyseal plate without interruption. Compare with Figs. 2–4.

density across the shaft ends characterized his first case. In another, in a newborn infant, roentgenograms demonstrated a second band of diminished density parallel to the opaque line. In addition to these features, Follis *et al.* found the long bones in two of their five cases, studied at autopsy, to be uniformly thickened throughout the entire shaft (4). They considered these changes as consisting of an "increase in the number and thickness of the trabeculae, due apparently to a lack of destruction of the calcified cartilaginous matrix substance which was then covered with a thick layer of bone."

AUTHORS' SERIES

An analytical review of all cases classified as erythroblastosis in the files of the Johns Hopkins Hospital furnished the material for this study. Since present methods of study fail to afford absolute pathologic proof of this disease, we were confronted by the necessity of establishing diagnostic criteria by which to evaluate this series. From the outset, it was decided that consideration be confined to infants of known Rh-negative mothers who had been hospitalized at this institution and who had received complete clinical and laboratory work-up, including technically satisfactory x-ray studies of all extremities. Jaundice and hepatic and splenic enlargement were deemed fundamental physical signs, essential to the diagnosis. Necessary laboratory findings were the presence of anemia, increased number of erythroblasts, and a negative serologic test for syphilis. In several cases which fulfilled these requirements, only postmortem films were available. Two cases without films were also included on the basis of necropsy data describing unmistakable microscopic changes.

Of the numerous cases of erythroblastosis registered at the hospital, the vast majority were automatically eliminated by the standards adopted. For example, in this institution, bone surveys are not routinely or ordinarily ordered for cases of this type. Adequate film studies of only 21 erythroblastotic infants were available for study, and 4 of these cases had to be discarded because the examination had been postponed until after the first several weeks of life. Furthermore, most attending physicians justifiably omit bone surveys in severely affected cases requiring emergency care. Usually these patients

are obviously erythroblastotic, and radiographic investigation is superfluous. Thus, the patients of this series constitute a distinct minority of a considerable number of proved cases.

Cautious scrutiny of the available films was repeated on several occasions by both authors, individually. Eight of the 17 cases were entirely negative for bone changes. Of the 9 remaining cases, 6 were characterized by transverse lines of increased density in the juxta-epiphyseal portions of the shaft ends. In the films of 3 of the infants, these features were accompanied by parallel lines of diminished density, proximal to the opaque stripes (Fig. 2). In all cases, these manifestations were symmetrically distributed in multiple bones, but only at the rapidly growing ends. Most frequently the distal extremities of the radius, ulna, tibia, and fibula were involved; the proximal ends of the humerus and femur were less often and less clearly affected. Analogous lines were not infrequently identified in round bones and epiphyseal centers. No evidence of delay in bone maturation, periostitis, or other abnormality was observed. Particular attention was directed to the occurrence of cortical sclerosis as described by Follis *et al.* and re-emphasized by Pillmore (10) and others. In no case was any alteration of shaft density observed.

Follow-up films were available in 4 cases, permitting an analysis of the evolution of these findings (Fig. 3). Transverse stripes, as described above, were absent in all. Nor were they present in the films of a second group of 4 cases examined after the first month of life. All, however, did show thin, dense diaphyseal bands of the "growth-arrest-line" type.

Correlation of the presence and extent of these osseous changes with the clinical and laboratory findings proved interesting. On the whole, the negative cases represented healthier individuals. Their recovery appeared to be more prompt and their hospital stay of shorter duration. Generally, those with transverse lines were more seriously ill. In addition, with several exceptions, those with the most extensive metaphyseal bands were the most severely affected.

Fig. 2. Erythroblastosis fetalis. White, male newborn infant with history of jaundice, enlargement of liver and spleen, anemia, and negative serology. Mother was Rh negative. Left wrist shows radiopaque and translucent bands at the metaphyseal ends of the radius and ulna.

In some cases, the metaphyseal bands were so distinct that it would certainly seem feasible to infer that they could be demonstrated in lateral maternal abdominal films of adequate technical quality. Surely, the optimum time for visualization of these signs occurs in the later prenatal stage, in which the need for all available information concerning the extent of the process is most urgent. Perhaps it will be possible to utilize these bone changes (in conjunction with the titer of maternal agglutinin) from a prognostic point of view.

DIFFERENTIAL DIAGNOSIS

To exclude the possibility that the phenomena described may represent *anatomical variants* in the absence of any pathological state, the authors reviewed an available research series of 200 long bone studies of selected normal infants. In not a single case was there evidence of metaphyseal striping (Fig. 1). Increased density of one or more epiphyseal plates

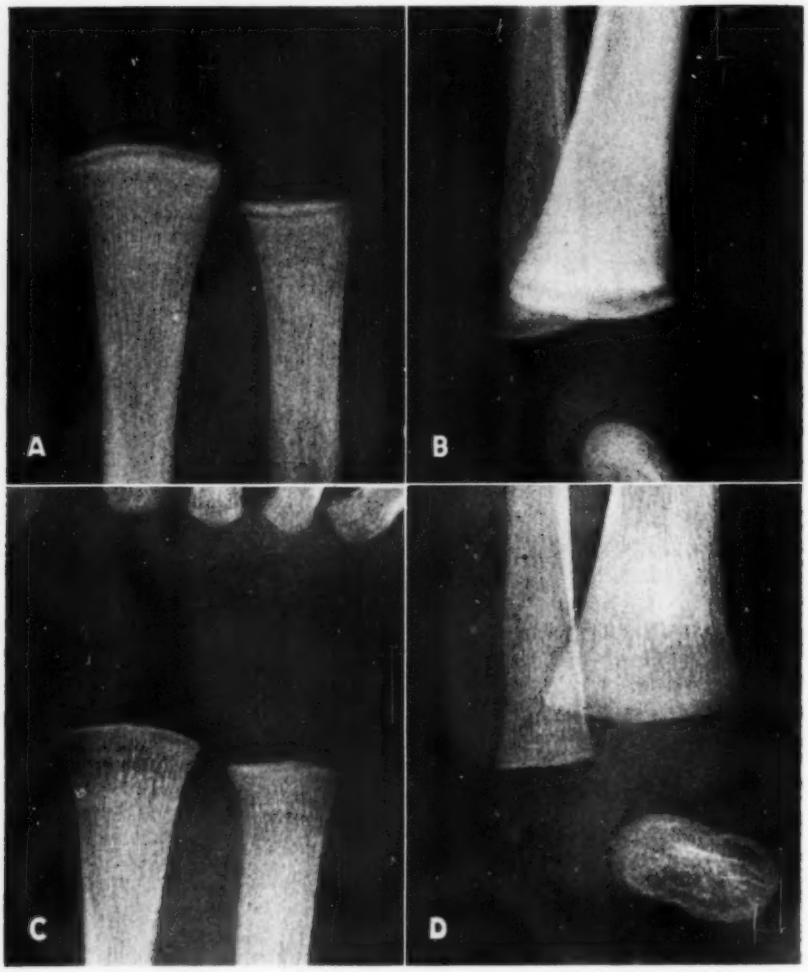

Fig. 3. Erythroblastosis fetalis. White, male newborn infant with deep jaundice, petechiae, hepatic and splenic enlargement, anemia, and negative serology. Mother was Rh negative. Right wrist (A) and right ankle (B) show radiopaque and lucent bands at the metaphyseal ends of the long bones. Follow-up examinations of right wrist (C) and right ankle (D) at age of three months demonstrates evolution of metaphyseal bands into "growth-arrest-lines" (easily visualized in the original films)

was not uncommon, however. Further experiments demonstrated that these apparent opacities are usually secondary to variations in positioning of the limb examined and/or direction of the radiant beam.

That transverse lines occur regularly in a host of conditions in infants and young children has been repeatedly stressed in both the pediatric and radiological literature. It is widely recognized that these changes are definitely non-specific and are of value only inasmuch as they indicate a disturbance in endochondral bone formation. The majority of these abnormal states are of no concern in the study of erythroblastosis because of the neonatal occurrence of that disease. Only those conditions affecting the fetus or the newborn infant call for attention here.

Although published data concerning the osseous characteristics of *premature infants* are meager, we have long recog-

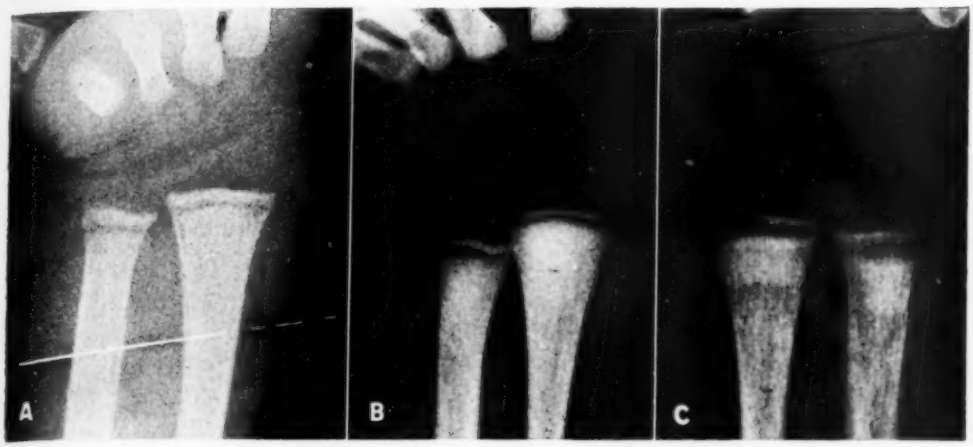

Fig. 4. Analogous osseous changes in other conditions than erythroblastosis.
A. Prematurity: Male newborn infant, birth weight 2,355 gm. Left wrist shows metaphyseal pattern similar to Figs. 2 and 3A.
B. Congenital syphilis: Female newborn infant. Mother was inadequately treated for proved syphilis. Right wrist shows metaphyseal changes similar to those of Figs. 2 and 3A.
C. Bismuth lines: Female newborn infant. Mother with positive serological test for syphilis received bismuth as part of antisyphilitic therapy during pregnancy. Left wrist reveals wide band of increased density in distal shaft due to bismuth deposition. Beyond this is a lucent stripe in the new bone formed since the last maternal bismuth injection.

nized the frequent occurrence of transverse lines in such cases. Examination of the roentgenograms of the extremities of 50 premature infants revealed positive findings in 11 cases, or 22 per cent (Fig. 4A). Only the over-all size of the part examined and the absence of secondary epiphyseal centers at the knee distinguished these films from those of erythroblastotic patients.

An extremely high percentage of cases of *infantile syphilis* show identical metaphyseal stripes (Fig. 4B). Differentiation is less difficult if destructive lesions also occur at the shaft ends. In many cases, however, these are entirely absent. The familiar signs of syphilitic diaphysitis—moth-eaten rarefaction, cortical thickening, etc.—usually appear after the first month and are of no diagnostic value in these cases.

Bismuth lines are usually found in newborn children delivered of mothers undergoing bismuth therapy for syphilis. These lines are heavier and wider than those under discussion (Fig. 4C). Although we have never encountered *fluorine lines*, we would expect the increased bone density from maternal fluorine poisoning to be more generalized.

Probably any significant *maternal illness during pregnancy* or *fetal disease* can cause similar lines. In the neonatal period, transient disturbances of bone development, as emphasized by Sontag, may result from the shift from placental to intestinal nutrition, endocrine lag, and other *readjustments necessary in the post-natal period* (8). Sontag has also reported a correlation between the formation of "tarsal striae" and the *process of birth itself* (9). In his experience, striae occur most frequently in first-born infants and in cases of forceps delivery and precipitate labor. If x-ray studies are not obtained in the first few days of life, the list of possible etiological agents must be extended to embrace the innumerable causes of *infantile malnutrition, acute and chronic illnesses, surgical procedures, heavy metal poisoning, etc.*

We have confined ourselves in this discussion to radiological considerations. From a clinical and laboratory standpoint, erythroblastosis differs markedly from any of the conditions enumerated above.

Knowledge of the fetal and maternal history alone will provide the correct diagnosis in most instances; only the osseous manifestations are similar.

DISCUSSION

To determine the role of the roentgenologist in the problem of erythroblastosis fetalis, we have analyzed a series of 21 proved cases of the disease. These constitute the largest collection yet reported. Transverse metaphyseal bands of increased and decreased density were symmetrically distributed in the long bones of 53 per cent of the cases studied. The most opportune time for demonstration of these roentgen signs was the first few days of life, when bone formation proceeds most rapidly. The wrist and ankle joints were, therefore, the most favorable sites for detection of minimal changes. In general, the findings were most extensive in the more severely affected infants. With clinical improvement, follow-up studies showed transition of the abnormal stripes into typical "growth lines." These lines were buried progressively deeper in the shaft with bone growth. It may be feasible to demonstrate transverse lines of suitable contrast prior to birth in adequate lateral views of the maternal abdomen.

Although an entirely satisfactory explanation of the exact pathologico-physiological mechanism involved in the production of these phenomena has not been advanced at this time, the histologic changes which parallel these roentgen signs are easily recognized and have been thoroughly studied. Microscopically, the opaque line consists of remarkably dense trabeculae with an increased amount of calcified matrix. Continuation of calcium absorption in the presence of trabecular formation produces the radiolucent bands often noted proximal to the more dense stripes. The etiologic factors at play in this instance are less obvious, as is the reason for the total absence of this change in cases of similar clinical course.

This survey disclosed no evidence to suggest that skeletal changes other than metaphyseal lines occur in erythroblastosis. Inasmuch as recent works stress the contention of Follis and his associates that cortical sclerosis represents a manifestation of the erythroblastotic process, this abnormality in particular was systematically eliminated. Why or how diffuse cortical sclerosis could occur in uncomplicated erythroblastosis is not apparent to us.

Innumerable unrelated conditions, both in the fetus and infant, may alter endochondral bone development to initiate metaphyseal bands. The underlying histologic appearance of these lesions lacks distinct characteristics and the gross pathological changes as reflected by the roentgen ray are likewise not pathognomonic. It must, therefore, be emphasized that the osseous lesions described in erythroblastosis are indistinguishable from those occurring in prematurity, chronic maternal illness, infantile syphilis, etc. Just as the presence of transverse lines in the newborn is not diagnostic of erythroblastosis, so one must recognize that absence of such findings in no way invalidates the clinical and laboratory diagnosis of the disease.

SUMMARY

1. Transverse metaphyseal lines occur in a significant percentage of cases of newborn infants affected by erythroblastosis fetalis.

2. These changes result from a transient disturbance of endochondral bone formation.

3. Roentgenologically, the lines are indistinguishable from those due to any similar prenatal interruption of bone development.

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SUMARIO

Patología Osea en la Eritroblastosis Fetal

Este repaso de 17 casos de eritroblastosis fetal en los que se contaba con radiografías esqueléticas obtenidas poco después del nacimiento tenía por objeto determinar la naturaleza de las alteraciones óseas presentes. En 8 los hallazgos fueron normales. En el resto, se descubrieron líneas transversales de mayor espesor en las porciones yuxtaepifisarias de los extremos de los huesos largos, que se imputan a trastorno pasajero de la osteogenia endocondral. Los exámenes subsiguientes de varios casos revelaron el reemplazo de dichas rayas transversales por delgadas franjas diafisarias del tipo de la línea de paro del desarrollo.

Roentgenológicamente, las alteraciones óseas descritas son indiferenciables de las debidas a cualquiera interrupción semejante de la osteogenia.

The Angiographic Demonstration of Pulmonary Arteriovenous Fistula[1]

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CONTRAST ANGIOGRAPHY in the diagnosis of pulmonary arteriovenous fistula was first recorded by Smith and Horton (24) in 1939. Their patient, a forty-seven-year-old male in whom cyanosis and clubbing of the fingers had been noted since the age of twenty-four, was examined first in 1932. At that time he was thought to have polycythemia vera. Five years later a bruit was heard at the base of the right lung and a density in the right lower lobe was demonstrable roentgenographically. Following the injection of a radiopaque medium into the basilic vein to visualize the pulmonary blood vessels, roentgenograms showed the density to be a vascular tumor and the diagnosis of hemangioma of the lung acting as an arteriovenous fistula was made. The patient was not treated.

The first successful surgical cure of a pulmonary arteriovenous fistula was reported by Hepburn and Dauphinee (12) in 1942. A twenty-three-year-old female complained of dizziness, faintness, and dyspnea. She was cyanotic, and was known to have had clubbing of the fingers since she was fifteen. Roentgenograms revealed a shadow in the right middle and lower lobes, which was diagnosed as a pulmonary arteriovenous fistula. A right pneumonectomy was done by Shenstone (21), and the patient made a rapid recovery, with prompt disappearance of the cyanosis and polycythemia and gradual improvement in the clubbing of the fingers.

In the accompanying table are listed data on 22 cases of pulmonary arteriovenous fistula recorded in the literature accessible to us. It will be noticed that the first accurately described case was recorded by Wilkens (28) in 1918. At the postmortem examination of a twenty-three-year-old girl it was noted that two vessels which emerged from a dilated branch of the artery to the left lower lobe joined to enter the pulmonary vein just before its entrance into the left auricle. Similar changes were found in the parenchyma of the right lung.

The ages in the reported cases, as shown in the table, varied from two days to forty-five years. There were 13 males and 9 females. Some degree of cyanosis was noted in 17 cases, and clubbing of the fingers and toes was found in 15. Nine patients had small hemangiomata of the skin or petechiae. In more than half of the cases some type of murmur was heard over the affected area. Red cell counts varied from normal to 11.4 million. Hemorrhage or epistaxis was reported in 9 cases. Other symptoms were dyspnea, cough, persistent headache, and a "lightheaded feeling."

The familial character of the lesion was stressed by Goldman (10), who observed its occurrence in two brothers. Whitaker reported (27) a family history of telangiectasis accompanied in one member by a proved pulmonary arteriovenous fistula.

Maier, Himmelstein, Riley, and Bunin (18) described a bacterial endarteritis in association with their case of pulmonary arteriovenous fistula.

None of the reported cases of arteriovenous fistula of the lung showed any remarkable cardiac enlargement, differing in this respect from arteriovenous fistulas of the peripheral circulation (13, 14). In explanation, Maier and his associates (18) point out that in a peripheral arteriovenous fistula there is an increase in all elements of the blood and in its total volume, thus

[1] From the Departments of Radiology and Surgery, Stanford University School of Medicine. Accepted for publication in May 1948.

increasing the cardiac output and causing dilatation of the heart. In pulmonary arteriovenous fistula they showed the increase to be only in the red cell mass which, according to them, has little or minimal effect upon the dynamics of the circulation.

In all of the reported cases, except that of Bowers (6), in a two-day-old child, evidence of a pulmonary lesion was disclosed by roentgenograms.

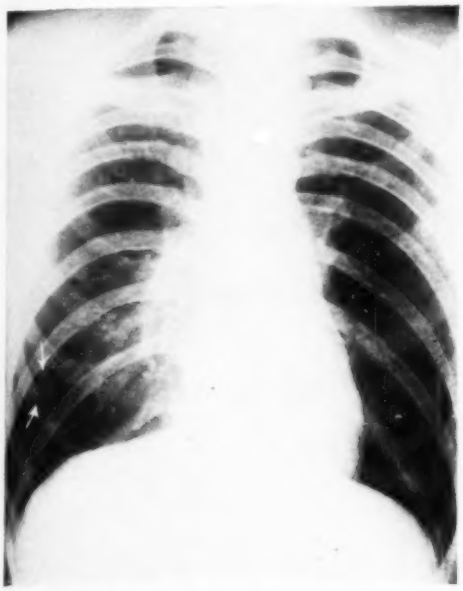


Fig. 1. Anterior view of the chest showing faintly outlined rounded density (indicated by arrows) in right lower pulmonary field.

As is apparent from the table, the signs and symptoms of this lesion vary greatly. In order of frequency they are: (1) abnormalities noted by roentgenographic examination, (2) cyanosis, (3) polycythemia, (4) clubbing of the fingers, (5) murmur over the affected lung, (6) hemoptysis.

The following case is presented to illustrate the value of contrast angiography and the rapid film-changing technic in making an accurate diagnosis of a pulmonary arteriovenous fistula:

CASE REPORT

Mr. R. W., 26 years old, entered Stanford University Hospitals on Aug. 3, 1947, under the care of Dr. Emile Holman. He had had four attacks of severe hemoptysis in the eighteen days preceding admission. A small "spot" on the right lower lobe of his lung had been discovered on a routine roentgenogram two years previously. Physical examination revealed no cyanosis or clubbing of fingers or toes. There was slight dullness to percussion at the right lower base posteriorly and laterally, with fremitus over the same area. No rhonchi, râles or murmurs were heard. There were no other pertinent physical findings.

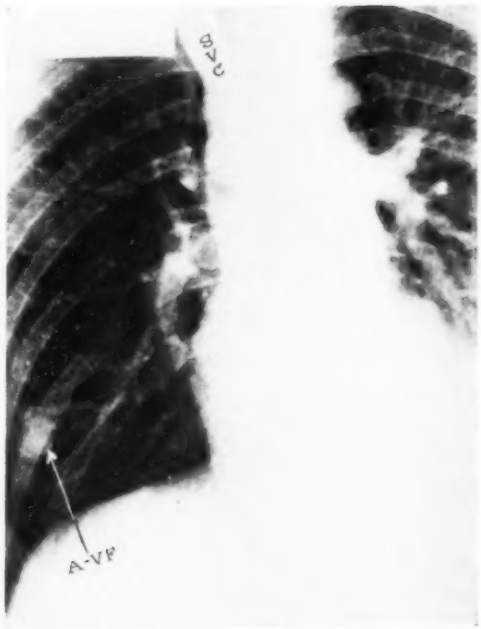


Fig. 2. Posterior view of chest one and a half seconds after the injection of diodrast was begun. Note superior vena cava (S.V.C.) and pulmonary lesion (A-V.F.) filled with diodrast.

Blood studies showed a red cell count of 5,800,000, hemoglobin 18.9 gm. (121 per cent Sahli), and a leukocyte count of 5,700 with a normal distribution.

At bronchoscopy a clot of blood was seen at the entrance of the bronchus to the right lower lobe.

Roentgenographic examinations (fluoroscopy, plain films, and laminagraphs) showed a discrete rounded density in the anterior medial part of the right lower lobe, measuring 1 × 1.5 cm., surrounded by an irregular area of lesser density (Fig. 1). A clinical diagnosis of hemangioma of the lung with a probable arteriovenous fistula prompted further studies by angiography. Diodrast (70 per cent) injected into the antecubital vein accumulated in the lesion after one and one-half seconds (Figs. 2 and 3), and the radiopaque material disappeared from the lesion after five and one-quarter seconds. The sequence of roentgenograms taken at rapid intervals showed a large pulmonary vessel entering the mass

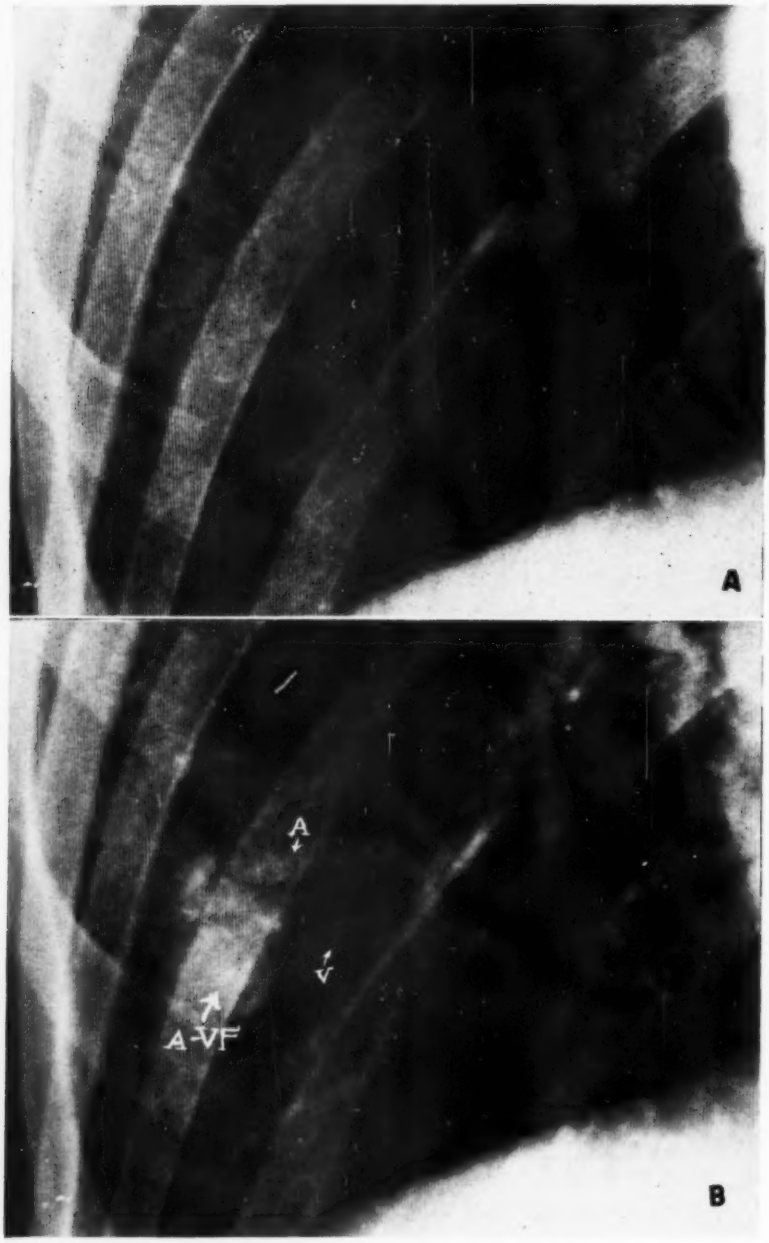
TABLE I: PULMONARY ARTERIOVENOUS FISTULA: REPORTED CASES

Author	Age and Sex	Clubbing of Fingers and Toes	Cyanosis	Hemorrhage	Trauma	Hemangiomata or Petechiae	Bruit or Heart Murmur	Lung or Part of Lung Involved	Roentgenogram, Tomogram or Angiogram	Hematocrit	Blood Count	Surgery	Result
Wilkens 1918	23 F	..	..	x	0	..	x	Rt.	x	..	.....	0	Died (autopsy)
Bowers 1936	2 days M	0	0	x	0	..	0	Lt.	0	..	.....	0	Died
Rodes 1938	25 M	x	x	x	0	x	0	R.M.L. L.U.L.	x	..	RBC 7.5 mil. WBC 9,800. Hemoglobin 113%	0	Died, hemorrhage
Smith & Horton 1939	40 M	x	x	0	0	0	x	Rt.	x	66	RBC 6.2 mil. WBC 3,200. Hemoglobin 23.7 gm.	0	Living
Duvoir 1939	12 F	0	0	0	0	x	x	L.L.L.	x	..	.....	Thoracotomy	Died 5 yr. postop. Proved L.L.L.
Hepburn & Dauphinee 1942	23 F	x	x	0	0	0	0	Rt.	x	..	RBC 9.8 mil. Platelets N. Hemoglobin 21.8 gm.	Pneumonectomy	Cured
Goldman 1943	22 M	x	x	0	0	x	0	Lt.	x	..	RBC 11.4 mil. WBC 4,100. Platelets 855,000	0	Unimproved. Pneumonectomy in1947. See Goldman below
Jones & Thompson 1944	24 F	x	x	0	0	0	x	R.U.L.	x	..	RBC 7.5 mil. WBC N. Platelets N. Hemoglobin 130%	Pneumonectomy	Cured
Janes 1944	30 M	0	x	x	0	x	x	Both	x	..	WBC 11,400	Multiple local resections	Improved
Adams *et al.* 1944	24 M	x	x	x	0	x	0	Lt.	x	82	RBC 7.2 mil. WBC 6,600. Hemoglobin 23 gm.	Pneumonectomy	Cured
Alexander 1945	41 M	x	x	0	x	x	x	Both mult.	x	..	RBC 8.5 mil. WBC 7,600. Hemoglobin 20.4 gm.	0	Died, coronary thrombosis
Sisson *et al.* 1945	45 F	x	x	x	0	..	x	R.M.L. L.L.L.	x	..	RBC 5.9 mil. WBC 9,000. Hemoglobin 14.5 gm.	0	Died after cardioangiography (70% diodrast)

TABLE I: PULMONARY ARTERIOVENOUS FISTULA: REPORTED CASES—*cont.*

Author	Age and Sex	Clubbing of Fingers and Toes	Cyanosis	Hemorrhage	Trauma	Hemangiomata or Petechiae	Bruit or Heart Murmur	Lung or Part of Lung Involved	Roentgenogram, Tomogram or Angiogram	Hematocrit	Blood Count	Surgery	Result
Makler & Zion 1946	17 M	x	x	x	0	0	x	Both	x	55	RBC 7.7 mil. WBC 6,500. Platelets 175,000. Hemoglobin 19.5 gm.	0	Unchanged
Watson 1947	27 M	0	x	0	0	0	0	R.L.L.	x	N.	RBC N. WBC N. Platelets and hemoglobin N.	Ligation of feeder artery	Improved
Watson 1947	21 M	x	x	x	0	x	0	R.L.L.	x	58	RBC 6.5 mil. WBC 6,000. Platelets 110,000. Hemoglobin 17 gm.	Rt. lower lobectomy	Cured
Goldman* 1947	22 M	x	x	0	0	x	0	Lt.	x	..	RBC 11.0 mil.	Pneumonectomy	Cured. Brother of following patient
Goldman 1947	32 M	x	x	0	0	0	0	....	x	..	RBC 7.0 mil.	.....	Brother of preceding patient
Case 33251, Mass. General Hosp. 1947	23 F	x	x	0	0	0	x	R.M.L.	x	67	RBC 7.1 mil. WBC 12,000. Hemoglobin 21.5 gm.	Rt. middle lobectomy	Cured
Whitaker 1947	44 F	x	x	0	0	..	0	R.L.L.	x	..	RBC 6.3 mil. WBC N. Hemoglobin 96%	Rt. lower lobectomy	Died 6 days postop., possible pulmonary embolism
Whitaker 1947	33 M	0	0	0	0	x	x	L.U.L.	x	..	.....	0	No further symptoms
Beierwaltes & Byron 1947	27 F	x	x	0	0	x	0	L.L.L.	x	75	RBC 8.2 mil. WBC 7,000 Hemoglobin 21.6 gm.	Lt. lower lobectomy	Cured
Maier *et al.* 1948	20 F	x	x	0	0	0	x	R.L.L.	x	70	RBC 6.9 mil. Hemoglobin 22 gm.	Rt. lower lobectomy	Cured
Authors' case 1948	26 M	0	0	x	0	0	0	R.L.L.	x	..	RBC 5.8 mil. WBC 5,700. Hemoglobin 18.9 gm.	Rt. lower lobectomy	Cured

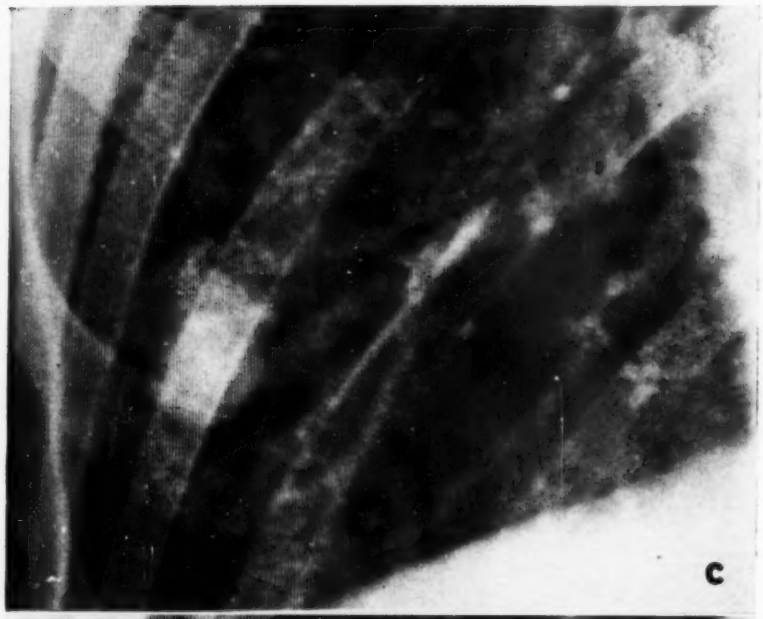
* Case first reported by Goldman in 1943 (see above).



Figs. 3. Detailed series showing appearance of pulmonary lesion prior to intravenous injection of diodrast and at intervals thereafter.

A. Prior to injection.

B. One and a half seconds following injection. Note clear demonstration of wide afferent blood vessel (artery A), diodrast-containing rounded structure (A-V.F.) and diodrast-containing efferent blood vessel (vein V).



C. Two and a quarter seconds following injection. Outlines of afferent arterial vessel are fading; efferent venous vessel becomes completely filled.
D. Five seconds after injection. Diodrast has disappeared from the lesion and pulmonary markings are now more accentuated.

Fig. 4. Roentgenogram of injected right lower lobe following lobectomy. A. Afferent arterial blood vessel. A-V.F. Arteriovenous fistula. V. Efferent venous blood vessel. Thorotrast was injected into the pulmonary artery.

and a similar vessel leaving it. Thus the clinical diagnosis of an arteriovenous fistula was confirmed.

On Aug. 9, 1947, a right lower lobectomy was performed. The specimen revealed a bluish, firm, rounded area on the upper medial surface of the right lower lobe. It had the appearance and consistency of an infarction rather than of a tumor. Further dissection of the pulmonary artery and vein in the median aspect of the lobe disclosed an arteriovenous fistula (Figs. 4 and 5). The surrounding tissue was dark reddish brown, presumably due to recent hemorrhage.

The patient made an uneventful recovery. Blood studies on Jan. 16, 1948, six months after operation, revealed a red cell count of 5,300,000, hemoglobin 16.8 gm. (108 per cent Sahli), and a leukocyte count of 6,200 with a normal distribution. The polycythemia and the increased hemoglobin noted in this patient in the presence of the arteriovenous fistula were similar to the blood changes noted by Blalock (5) in dogs following the experimental production of arteriovenous fistula in the pulmonary circulation.

CONCLUSIONS

The only characteristic clinical features presented by this patient were hemoptysis and a mild polycythemia. Although laminagraphs and plain films showed large pulmonary vessels connected with an intrapulmonary mass, an accurate diagnosis could not have been made except by angiography and the use of a rapid film-changing technic which permits taking a number of pictures in rapid succession. This is well demonstrated in Figure 3,

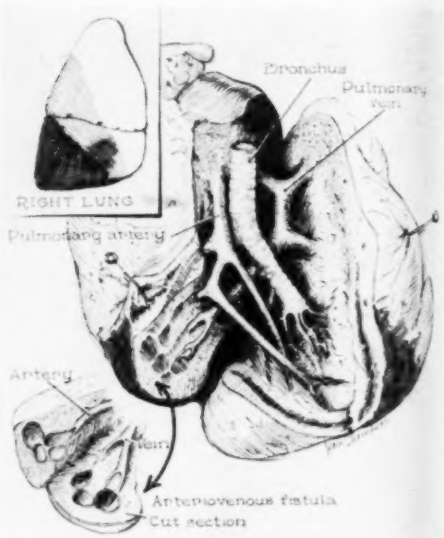


Fig. 5. Artist's drawing of resected right lower lobe after dissection of blood vessels and bronchi. Afferent pulmonary artery, arteriovenous fistula, and efferent pulmonary vein, are indicated on the drawing.

showing four films taken at intervals of three-quarters of a second. Here, in approximately two and one quarter seconds, the opaque material has outlined successively the afferent arterial vessel, the arteriovenous fistula itself, and the efferent venous vessel. If only two or three films had been taken in the fifteen to twenty seconds following the injection of the opaque material, it is quite probable that the demonstration of the lesion would have failed.

Moreover, in several of the reported cases, multiple lesions were found at operation. Angiocardiography seems advisable, therefore, prior to operation in every case of suspected arteriovenous fis-

tula of the lung. Lesions hidden behind the dome of the diaphragm or behind the cardiac shadow, or small lesions not detectable in an ordinary roentgenogram, may be disclosed.

SUMMARY

A 26-year-old male, who had had four severe hemorrhages within eighteen days, was found by angiography to have an arteriovenous fistula of the right lower lobe, which was cured by lobectomy.

In the angiographic demonstration of an arteriovenous fistula of the lung, it is important to employ a device for the rapid changing of films (23) in order not to miss the salient features.

A review of 22 published cases of pulmonary arteriovenous fistula shows the symptoms and signs, in order of frequency, to be: (1) roentgenographic evidence of a pulmonary abnormality, (2) cyanosis, (3) polycythemia, (4) clubbing of fingers, (5) murmurs over the affected lung, (6) hemoptysis. Whenever any combination of these signs is encountered clinically, an arteriovenous fistula of the lung should be suspected, and angiography should be performed.

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(For Spanish Summary, see following page)

SUMARIO

Revelación Angiográfica de Una Fístula Arteriovenosa del Pulmón

Un varón de 26 años, que había experimentado cuatro hemorragias graves en término de dieciocho días, tenía, según demostró la angiografía, una fístula arteriovenosa del lóbulo inferior del pulmón derecho, que curó la lobectomía.

El repaso de 22 casos publicados de fístula arteriovenosa del pulmón revela que los síntomas y signos, en el orden de su frecuencia, son: (1) signos radiográficos de anomalía pulmonar; (2) cianosis; (3) policitemia; (4) dedos hipocráticos; (5) soplos sobre el pulmón afectado; (6) hemoptisis. Siempre que se encuentre clínicamente una combinación de dichos signos, debe sospecharse fístula arteriovenosa del pulmón y ejecutarse una angiografía. Para este propósito, resulta importante emplear un artefacto que permita cambiar rápidamente las placas a fin de no pasar por alto las características sobresalientes.

The Compatibility of Castor Oil and Priodax in Concurrent Examination of the Colon and Gallbladder[1]

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IN AN EFFORT to arrive at an accurate diagnosis in the presence of abdominal complaints, the radiologist is not infrequently called upon to examine the gallbladder, the colon, and the upper gastro-intestinal tract of the same patient. On occasion it may be desirable, for one reason or another, to perform the three examinations concurrently, on the same day. An advantage exists both for the patient and the radiologist in such a procedure. Instead of a minimum of three half days lost from work, the outpatient thus loses only one, which may represent a considerable item in the cost of his examination. His preparation is reduced to a single period of fasting and enemata. If he must commute from out of town, there is a still greater saving in time and expense. The radiologist avoids triplicating appointments, reports, filing, linen, gowns, etc.

Concurrent examination of the gallbladder and the upper gastro-intestinal tract occasions no difficulty and has become routine in some departments of roentgenology. Similarly, the upper gastro-intestinal tract can be satisfactorily examined immediately following the evacuation of the barium enema, providing the bowel has been properly cleansed by cathartics and enemata so that evacuation is satisfactory. Since the stomach and duodenum lie above the colon, an average residue of barium in the latter interferes with a satisfactory examination of the upper gastro-intestinal tract in less than 5 per cent of the patients, who must be asked to return to the department on another day for a re-examination of the stomach and duodenum. It is the purpose of this study to suggest that the gallbladder and colon can also be examined on the same day.

[1] Accepted for publication in June 1948.

Adequate preparation of the colon for a barium enema requires the use of an efficient cathartic, one which will cleanse the bowel thoroughly without producing diffusion into, and subsequent retention of large amounts of fluid within, the intestinal lumen. Weber (1), after investigating all of the available cathartics, has found castor oil to be the most efficacious agent for this purpose. The use of castor oil results in a clean bowel of good tone without causing the patient undue distress.

Castor oil, the triglyceride of ricinoleic acid, behaves in the stomach like other fatty substances, retarding emptying time, and should therefore be taken on an empty stomach. In the intestine, the triglyceride is hydrolized by fat-splitting enzymes to glycerol and ricinoleic acid. The latter is a marked irritant and stimulates the motor activity of the small intestine by a local irritant action, causing rapid propulsion of the contents. The colon is stimulated little, for in passage through the small intestine, the ricinoleic acid is absorbed in a manner analogous to that of other fatty acids. The fluid nature of the stool excreted in response to castor oil is not due to diffusion of fluid into the bowel, but results from the fact that the intestinal contents are propelled so rapidly through the small intestine and colon that absorption of fluid is limited. The adult dose is from 15 to 30 c.c. Larger amounts produce no greater effect, inasmuch as the hydrolysis of the oil is self-limited. When sufficient ricinoleic acid is released to irritate the intestine, the remainder of the acid is swept out of the bowel still combined with glycerin. For this reason castor oil is a relatively safe cathartic. It usually produces one or two copious semifluid stools within two to six hours, with little accompanying intestinal griping (2).

Because castor oil is a fatty substance, and because such substances are known to produce contraction and emptying of the gallbladder, administration of this cathartic a short time before the ingestion of gallbladder dye would seem paradoxical. The present study was undertaken to determine just what effect the administration of castor oil prior to the ingestion of Priodax (beta-(4-hydroxy-3,5-diidophenyl)-alpha-phenyl-propionic acid), would have on the concentration of the latter substance in the gallbladder and visualization of that organ.

In 50 consecutive unselected cases, in which either a cholecystogram or barium enema had been requested, both castor oil and Priodax were given on the day prior to the concurrent examination of the two organs. It was planned to give the patient $1\frac{1}{2}$ ounces of castor oil at 4:00 P.M., allow a light, fat-free, low residue supper at 5:30 P.M., and to give six Priodax tablets at 6:00 P.M. The patient was instructed to eat or drink nothing after midnight and to report to the x-ray department at 8:00 the following morning. Upon arrival, roentgenograms of the gallbladder were obtained—coned views on 8 × 10 inch film. Two exposures were made as "scout" films, one of which was usually satisfactory for inclusion in the series. After these films were viewed wet, two more localized exposures were made. Two ounces of cream were then given, and a third set of films was made in forty-five minutes. Immediately following the viewing of this last set of films, the barium enema was administered under fluoroscopic observation and one post-evacuation film was taken routinely. In approximately one-third of the cases, the upper gastrointestinal tract was examined following the evacuation of the barium enema.

In an effort to obtain more complete evacuation of the barium enema, with retention of a good mucosal pattern, the suggestion of others that tannic acid powder be added to the barium suspension was followed, with good results. There was more uniform evacuation of the colon, with definite improvement in the mucosal relief pattern. One level tablespoon of the U.S.P. Tannic Acid Powder was added to two quarts of the barium suspension.

The 50 patients in the group studied varied in age from seventeen to fifty-nine years, with an average of 29.6 years. There were 5 patients under the age of twenty, 26 patients in the third decade, 17 in the fourth, 1 in the fifth, and 1 in the sixth. Forty-seven were males and 3 females. Both patients in the older age group showed excellent concentration. The interval between the administration of the castor oil and the ingestion of the Priodax tablets varied from forty-five minutes to four hours, averaging two hours and eight minutes.

RESULTS

The density of the gallbladder shadow obtained in these 50 cases appeared to vary no more than in a comparable group in which castor oil had not been given. In an attempt to determine the relationship between the administration of the castor oil and the Priodax, the shadow was arbitrarily classified as optimum, good, fair, and poor. Table I lists the number of cases falling into each group. While the series is too small for statistical analysis, there appears to be no definite relationship between the density of the shadow and the time interval in the range of forty-five minutes to four hours.

TABLE I: DENSITY OF THE GALLBLADDER SHADOW IN RELATION TO THE TIME INTERVAL BETWEEN ADMINISTRATION OF CASTOR OIL AND INGESTION OF PRIODAX TABLETS

Time Interval	1 Plus	2 Plus	3 Plus	4 Plus	No Function	Total
Less than 60 minutes	0	1	1	2	0	4
60–120 minutes	0	1	12	7	0	20
Over 120 minutes	0	3	11	11	1	26

Forty-nine of the cases were interpreted as showing a normally functioning gallbladder. In one case there was no concentration of the dye. This patient was subsequently examined in the routine manner, receiving Priodax without castor

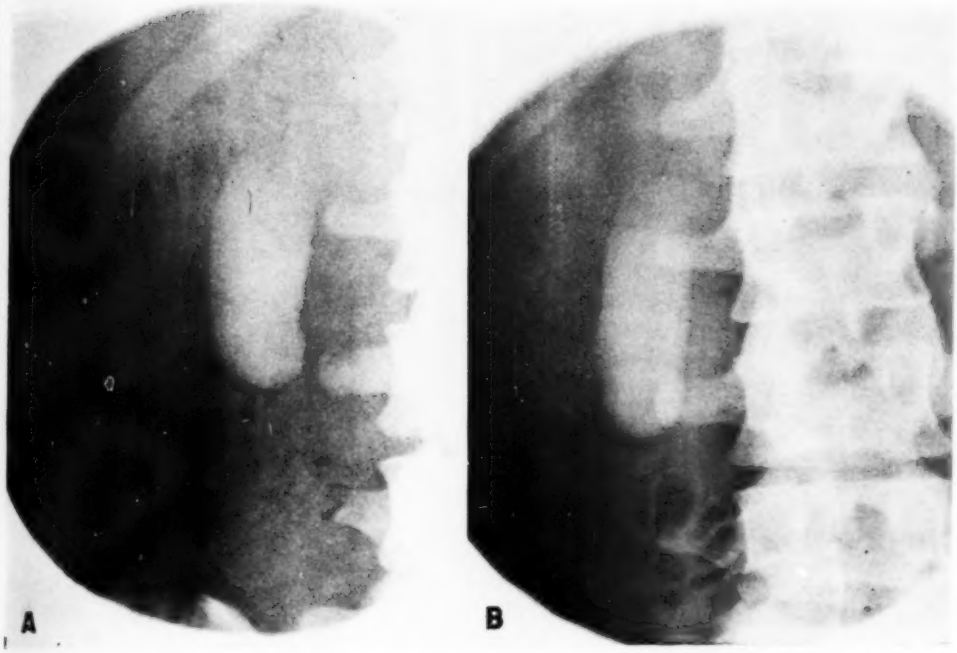

Fig. 1. A. Cholecystogram obtained with Priodax in the usual manner. B. Cholecystogram on the same patient following administration of castor oil and Priodax. The shadow is slightly smaller.

oil, a double dose of Priodax, tetra-iodophenolphthalein, and finally intravenous iodophthalein, without a suggestion of a gallbladder shadow in any instance. Because of the absence of symptoms referable to the gallbladder, this patient was not explored. Cholecystography was repeated in 11 of the 49 normal cases, with Priodax given in the routine manner, for comparison. No significant difference was found in the visualization obtained by the two methods. Five patients showed a slightly smaller gallbladder shadow when castor oil had been administered than when the Priodax alone was used; in the remaining 6 cases the shadows were practically the same (Figs. 1–3). While 50 cases constitute a very small series, it would seem fair to presume, at least, that castor oil given prior to the administration of Priodax does not result in poor visualization or non-visualization of the gallbladder, and that a satisfactory examination of the colon and the gallbladder can be accomplished at one appointment. As mentioned above, examination of the upper gastro-intestinal tract may be added to that of the gallbladder and colon on the same day, without difficulty (Fig. 4).

DISCUSSION

The very slight effect of the administration of castor oil prior to the ingestion of Priodax upon visualization of the gallbladder, as observed in this study, came as something of a surprise, since it is well known that fatty oils cause emptying and contraction of the gallbladder. It is probable that contraction does occur initially in response to the castor oil, but, as pointed out above, the action of the cathartic is rapid and self-limited. Its initial effect upon the gallbladder has probably subsided well before that organ receives the absorbed contrast medium from the liver.

While the importance of a fat-free meal prior to the oral ingestion of the cholecystographic medium has been repeatedly emphasized, the concept of the administration of fat prior to cholecystography is not

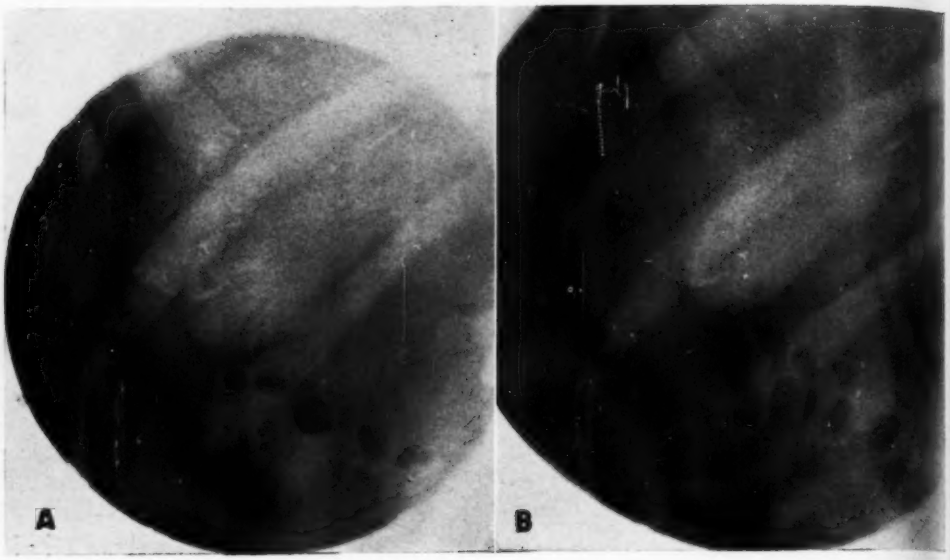

Fig. 2. A. Cholecystogram obtained with Priodax in the usual manner. B. Cholecystogram on the same patient following both castor oil and Priodax: shadow 10 per cent smaller.

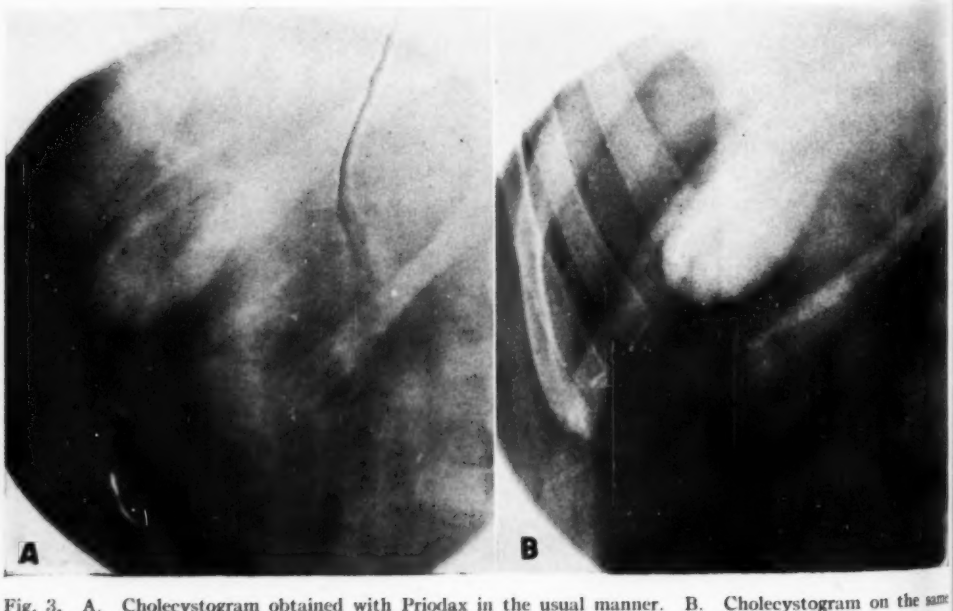

Fig. 3. A. Cholecystogram obtained with Priodax in the usual manner. B. Cholecystogram on the same patient following both castor oil and Priodax: shadow almost identical with A.

new. Brewer (3) feels that a high fat diet prior to cholecystography will increase the accuracy of the examination. This author quotes others, who feel that a high-fat meal is to be preferred prior to oral cholecystography. It is not within the scope of this paper to enter into this discussion, but it is interesting to note that others have

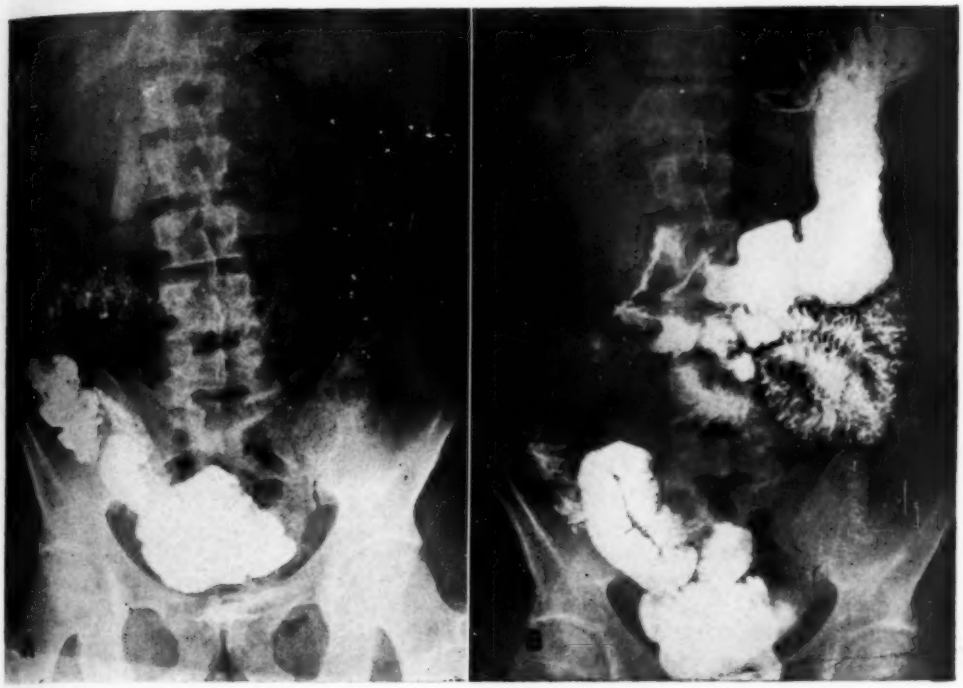

Fig. 4. Concurrent examination of the gallbladder, colon, and upper gastro-intestinal tract on the same morning. Tannic acid was used in the barium enema.

found that a fatty substance given before examination of the gallbladder does not interfere with satisfactory visualization of this organ.

SUMMARY

1. The colon and gallbladder in 50 entirely unselected cases were examined concurrently on the same morning, following administration of castor oil and Priodax.

2. The administration of castor oil prior to the ingestion of Priodax did not interfere with satisfactory visualization of the gallbladder.

3. In 12 cases examined with prior administration of castor oil and also in the usual manner, with Priodax alone, no significant difference was found in visualization of the gallbladder with the two methods.

4. The interval between the administration of the castor oil and the Priodax, within a range of forty-five minutes to four hours, bore no relationship to the density of the gallbladder shadow.

5. While this series of 50 cases is small, it appears safe to presume that the gallbladder and the colon can be examined concurrently at one appointment by this method.

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(For Spanish Summary, see following page)

SUMARIO

Compatibilidad del Aceite de Ricino y del Priodax en el Examen Concurrente del Colon y de la Vesícula Biliar

En 50 casos absolutamente tomados al azar examináronse concurrentemente en la misma mañana el colon y la vesícula biliar, después de la administración de aceite de ricino y de Priodax.

La administración de aceite de ricino antes de la ingestión de Priodax no impidió la satisfactoria visualización de la vesícula biliar.

En 12 casos examinados con Priodax después de administrar aceite de ricino y también en la forma acostumbrada, con Priodax solo, no se observó mayor diferencia en la visualización de la vesícula biliar con las dos técnicas.

El tiempo transcurrido entre la administración del aceite de ricino y del Priodax, dentro de un límite que varió de 45 minutos a 4 horas, no guardó relación alguna con la densidad de la sombra del colecisto.

Si bien la serie actual de 50 casos es pequeña, parece justificado presumir que, con esta técnica, pueden examinarse la vesícula biliar y el colon concurrentemente.

Mycetoma Pedis[1]

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MYCETOMA PEDIS, or Madura foot, was first described as a clinical entity by Gill in 1842, from the Madura dispensary in India. In 1858, Rustomji first recognized the fact that in some cases black granules and in others yellow granules were present in the tissues. Carter, in 1880, used the color of the granules as a basis of classification. He believed, however, that all cases were due to the same fungus, and from this he called the disease mycetoma. In 1894 Boyce and Surveyor discovered that the condition was produced by more than one group of organisms. Further studies isolated *Actinomyces* from some cases and true fungi from others. Pinoy, in 1913, suggested that the name mycetoma be reserved for the latter group of cases, and that those due to *Actinomyces* be called actinomycosis. In 1916, however, Chalmers and Archibald redefined the term mycetoma to include all infections caused by mycotic organisms in which granules, comprised of the organisms, are present in the tissues.

Madura foot is not an uncommon occurrence in the tropical regions of the world—India, Africa, Central America, South America, and the Netherland East Indies. In temperate climates it is more unusual, although a considerable number of cases have been reported in the United States, chiefly in the South, and a few in Canada. The usual mode of infection is thought to be from the soil, through an abrasion in a foot unprotected by a shoe. Consequently, laborers and particularly farmers of the poorer class, who go barefoot, are most commonly affected. A history of trauma and contact with the soil is not always obtainable, however, and it may be impossible to trace the source of infection.

The causative agent of mycetoma may be any one of a variety of species of *Actinomyces* or true fungi. The pathologic changes and the clinical course, however, are the same regardless of the etiologic agent. Laboratory studies are necessary in order to differentiate one infection from another.

The clinical course is slow and progressive, cases having been reported with a duration of twenty years. Early symptoms may consist of pain and tenderness. Then a hard, deep-seated, fixed nodule develops. Swelling gradually extends peripherally about the nodule and other nodules appear. These soften and after a few days rupture spontaneously, discharging fluid containing the characteristic granules. Drainage continues for a few days and then gradually diminishes, the fistula crusting and healing over. As the disease progresses, all stages may be present—draining sinuses, encrusted lesions, and small scars from old lesions. The individual sinuses lead to deep-seated abscesses. The swelling gradually involves the entire foot, leading to a massive globose deformity. The subjective symptoms are usually slight. There may be some pain just before rupture of a nodule, and patients sometimes complain of a deep aching or sensation of fullness. Locomotion is usually well maintained, although the size of the foot is a handicap. Unless there is secondary infection, there is no general systemic reaction, and regional adenopathy is uncommon.

When the involved foot is dissected, one finds deep-seated abscesses with multiple tortuous and connecting sinuses. Fascial planes offer no barrier to the infection and none of the tissues show any resistance to the disease, muscle, fat, and bone being

[1] From the Department of Radiology, University of Tennessee Medical College, Memphis, Tenn. Accepted for publication in May 1948.

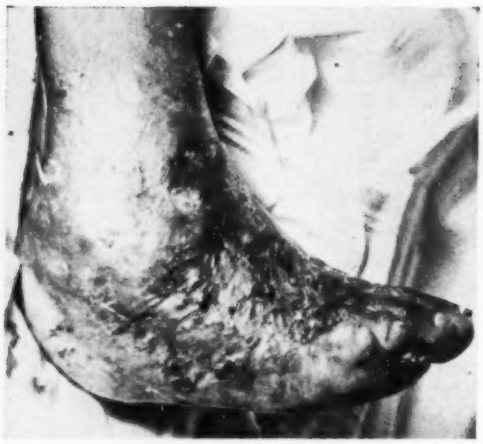


Fig. 1. Globular enlargement of foot with multiple sinus tracts caused by Mycetoma pedis.

involved with the connective tissue. As the sinuses heal, they are replaced by dense connective tissue. In many areas tendons, bones, and other anatomical landmarks disappear completely.

The microscopic appearance of mycetoma pedis is similar in all cases, regardless of the etiologic organism. The microorganisms occur in colonies and send out radiating mycelial threads. Immediately surrounding the colonies is a zone of leukocytic infiltration, and adjacent to this a layer of granulation tissue heavily infiltrated with inflammatory cells of all types. Beyond the layer of granulation tissue, dense hyalinized connective tissue is found.

The principal roentgen findings in Madura foot are decalcification and atrophy of bone, with cystic destruction, and extreme swelling of the soft tissues. Multiple round areas of bone destruction involve the phalanges, metatarsals, and tarsal bones. These represent the sinus tracts. They may be in the central portion of the bone and the smaller bones may show expansion in this region. Other tracts involve the bone on one edge, producing a half-moon type of defect. The remarkable feature is the absence of surrounding bone reaction or sclerosis. Some areas show complete bone destruction. Fusion between bones may be encountered, particularly in the tarsal region, apparently due to an old productive periostitis. All of the bones show extreme decalcification.

The infectious process also involves the joints. In some cases the bone on either side of the joint space is completely destroyed. Others show partial destruction involving the adjacent articulating surfaces and a decrease in joint space. In still others bony ankylosis may occur.

The treatment of mycetoma pedis is discouraging. Dixon has reported one case cured with sulfanilamide therapy. No other form of treatment has been successful. In far advanced cases amputation is usually necessary.

CASE REPORT

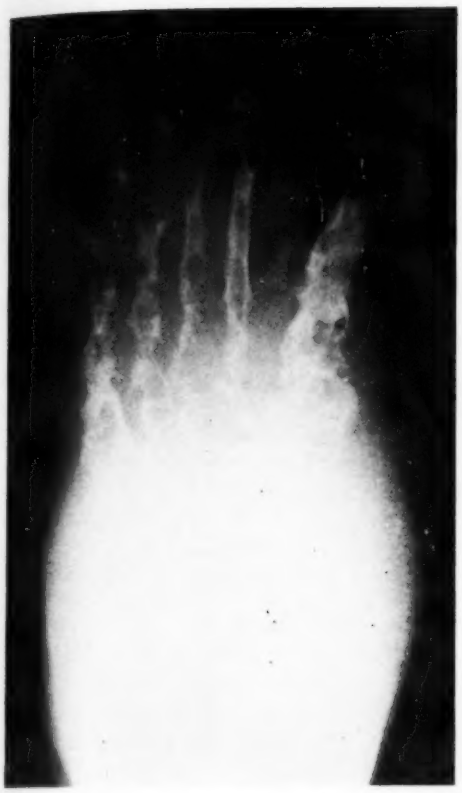
W. M., a 37-year-old colored male, was admitted to the John Gaston Hospital, Memphis, Tenn., on March 23, 1948, with swelling of the right foot of eight years duration. He stated that his foot had bothered him ever since he "dropped a piano on it in 1940." Shortly after that accident, he had consulted a physician, who found no fracture or other lesion. For the next two years there were mild intermittent aching pain and slight swelling. In 1942, the swelling became worse and another physician incised the foot on the dorsal and plantar surfaces, but no pus was encountered. Soon after this, multiple sinuses appeared, each sinus draining for a few days and then crusting over and healing. For six years before admission there had been progressive swelling of the foot, with the appearance of sinuses from time to time, which always healed spontaneously. The patient stated that he was able to work and that walking did not cause any pain, although it was troublesome because of the size of the foot. It was necessary to buy a large shoe and cut it in several places. The only pain was a throbbing pain at night.

The patient had lived in the city for many years and had not been in the country or gone barefoot for twenty years. The only abrasion he could recall dated back some twenty-five years, and was caused by sticking a thorn in the foot. He gave a history of receiving "shots for bad blood" in 1942.

Physical examination was negative except for the right foot, which with the ankle was excessively swollen. Numerous small draining sinuses were present over the dorsal and plantar aspects, with a foul-smelling discharge. The skin of the foot was hyperpigmented and encrusted in places. Numerous small scars were present. (Fig. 1.)

Blood counts and urinalysis were normal and the blood Kahn reaction was negative.

X-ray examination of the foot revealed extreme



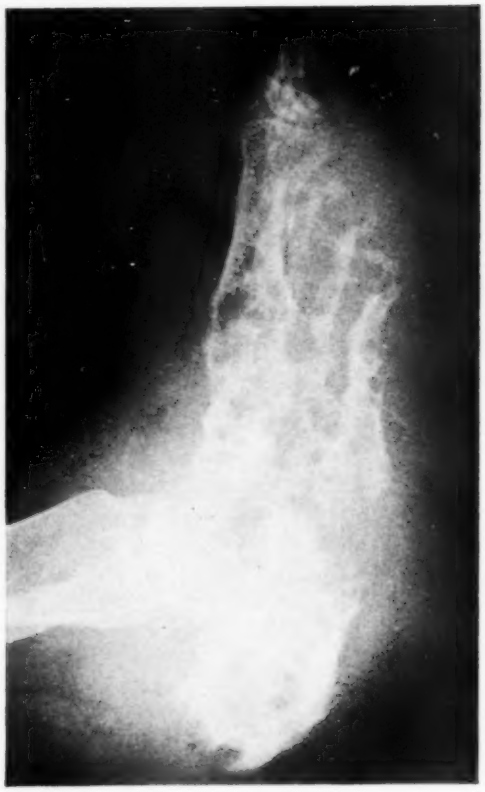


Fig. 2 (left). Cystic areas of bone destruction with little surrounding bone reaction.
Fig. 3 (right). Oblique view of foot.

soft-tissue swelling with globose deformity. All of the bones were decalcified to a rather marked degree, and all showed multiple areas of destruction, the metatarsals and tarsals being involved to a greater extent than the phalanges. The areas of destruction were oval or round and of different size, measuring up to about 7 mm. in diameter. Some were completely surrounded by bone. Others involved the edge of a bone, producing a half-moon defect. Very little surrounding bone reaction was observed. The second and third cuneiforms were almost completely destroyed. The first and second metatarsophalangeal joints showed a marked reduction in joint space and there was complete ankylosis of the fifth metatarsophalangeal joint. (Figs. 2 and 3.)

Biopsy revealed a colony of fungi showing mycelia and eosinophilic clubs. Inflammatory reaction was present about the colony and granulation tissue beyond this. The fungus proved to be *Actinomyces nocardia*.

With the diagnosis of Madura foot established, the right leg was amputated 7 inches below the knee joint. A cross section was then made in the region of the metatarsals. The bones offered little resistance to sectioning and on inspection of the cut surfaces, the bony structures could not be definitely identified. The cross section presented a surface studded with caseous areas filled with a green-yellow pus, each area being surrounded by a zone of glistening yellow tissue. These represented long sinus tracts involving the entire foot and ankle.

SUMMARY

1. The characteristic clinical observation in Mycetoma pedis, or Madura foot, is chronic and long-standing globose swelling of the foot, with multiple draining sinuses.

2. The principal roentgenographic findings are cystic destruction of bone, with little surrounding bone reaction, and irregular thinning of the shafts of the tarsals, metatarsals, and phalanges.

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SUMARIO

Micetoma Podal

El micetoma podal o pie de Madura se debe a varias especies de actinomicetos y de verdaderos hongos. Clínicamente, la evolución es lenta y progresiva, consistiendo la característica principal en un edema globoso crónico y prolongado del pie con muchas fístulas supurantes. Las radiografías revelan osteólisis quística con poca reacción del hueso circundante y adelgazamiento irregular de las diáfisis de los tarsianos, metatarsianos y falanges.

Comunícase un caso.

Radiation Therapy of the Guillain-Barré Syndrome[1]

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ENCEPHALOMYELORADICULITIS is an obscure clinical entity which has been the subject of considerable investigation, but its etiology remains unknown and therapy has been of a palliative nature only. This report deals with the clinical features of the disease and records the results of roentgen therapy in two cases, one the chronic type of involvement, and the other acute in character.

In 1892, Osler (1) gave a clinical description of the syndrome, which he called "infectious polyneuritis." The cerebrospinal fluid was not examined. Guillain and Barré (3), in 1916, reported a carefully studied series of cases and called attention for the first time to the fact that a normal cerebrospinal fluid cell count, associated with a high protein level, was the distinguishing characteristic of the syndrome. Several writers (2, 4, 5) have confirmed this observation. A number of names have been applied to the condition. Bradford, Bashford, and Wilson (4) reported 30 cases and stressed the importance of albuminocytologic dissociation as the distinctive feature. They coined the term, "acute infective polyneuritis." The nomenclature of this syndrome also includes "acute ascending paralysis" (5) and "infectious neuronitis" (2).

The authors cited above described an acute disease of the central nervous system characterized by a sudden onset and afebrile course, a flaccid paralysis involving cranial as well as peripheral nerves, radiculitis, and muscular soreness, with little or no involvement of the sensory tracts. There was an antecedent acute infection in most cases. The course was of several weeks duration, ending in recovery.

More recently, McIntyre (7) and De Jong (8) have recorded a large series of cases and showed that the syndrome includes not only the acute cases ending in recovery, but also a second group running a protracted course, frequently with the development of permanent paralysis, and a third group terminating fatally, usually from bulbar paralysis. The clinical manifestations were similar in all groups, and albuminocytologic dissociation as described by Guillain and Barré was present in all cases.

Most workers believe that some filtrable virus is responsible for the Guillain-Barré syndrome, although no specific virus has been proved to be the sole causative agent. Many authors have emphasized the frequency of antecedent upper respiratory infection. Others have reported diphtheria, thermal burns, and measles preceding the onset of the syndrome. It may well be that multiple neurotoxins are capable of producing the pathological changes found in these cases. The process is usually widespread, involving the brain, spinal cord, and peripheral nerves. Most of the changes are degenerative in type. Beading and fragmentation of the axis cylinders and myelin sheaths, proliferation of Schwann cells, and, to a lesser degree, phagocytic and lymphocytic infiltration are characteristic. Changes outside the nervous system include infiltration, with focal degeneration in the liver, degenerative changes in the adrenal

[1] From the Departments of Roentgenology and Medicine, respectively, Wyoming County Community Hospital, Warsaw, N. Y. Accepted for publication in May 1948.

cortex, and interstitial cellular infiltration of the kidneys without nephron damage.

There being no proved causative agent of the disease, no specific therapy has been suggested. Palliative measures for the relief of pain, and physical therapy to prevent muscular contractions, have been used quite uniformly. Large doses of vitamin B complex have been administered, but none of the authors feel that it is of specific value. More recently, Shaffer (10), Blattner (11), and others have demonstrated that neostigmine gives quite striking relief of symptoms.

The fact that severe radicular pain is often relieved by roentgen therapy suggested to us that the symptoms of the Guillain-Barré syndrome might be benefited by such treatment. Rosselet and Sarian (12), Glenn (13), Tchaperoff (14), and other authors have shown that x-rays in appropriate dosage stimulate phagocytosis, and augment antibody production, hastening the recuperative process in many types of infection. It therefore seemed reasonable to hope that roentgen therapy might exert some curative as well as palliative effect in the syndrome under consideration. These considerations led us to use roentgen therapy in two cases, one chronic and the other of acute type.

CASE I: C. A. R., a single female, aged 23, became suddenly ill on Dec. 26, 1945, with low back pain, soon followed by severe pain in the left leg. The onset of symptoms had been preceded by an upper respiratory infection. Spinal rigidity soon became marked, and paralysis of the left leg followed. Bed rest, physical therapy, vitamin B complex, and analgesics were used without benefit. Pain was so severe that the simplest nursing procedures could be tolerated only after the administration of opiates. The course was afebrile and leukocytosis was absent.

The patient was hospitalized and first came under our observation on July 23, 1946. She appeared acutely ill, emaciated and dehydrated, obviously in severe pain. The temperature was 98.6°, the pulse rate 92 per minute, and the blood pressure 116/74. Significant physical findings included marked rigidity of the cervical and thoracic spine, with extreme tenderness of the muscles of the back and left leg. Flaccid paralysis of the left leg was complete except for minimal contractile power of the quadriceps group. The patient complained of marked paresthesias, but sensory tests were normal except for a diminution of vibratory sensation in the left ankle and foot. The cranial nerves, upper extremities, and right leg were negative to examination. Urinalysis was negative except for evidence of dehydration. The hemogram showed only slight secondary anemia. The sedimentation rate was 2 mm. in one hour (Wintrobe, corrected). The blood and spinal fluid Wassermann reactions were negative. The spinal fluid was under normal pressure and the dynamics were normal; the total cell count was 11 per cu. mm.; total protein 288 mg. per 100 c.c.; all cultures were sterile, and the colloidal gold curve was of the heterogeneous type. Roentgenograms of the skull, spine, pelvis, and left leg were normal.

Initial therapy included parenteral fluids, physiotherapy, supplemental vitamins, and analgesics. The pain was intense, opiates affording only minimal relief. An adequate diet could not be given.

On the sixth hospital day, roentgen therapy was given to the lumbar area of the spine, the field measuring 8 × 20 cm. The factors used in all treatments were: 200 kv., 0.5 mm. of copper and 1.0 mm. of aluminum filtration, distance 50 cm. At the first treatment, 150 r, measured in air, were administered.

The following day the nurse's notes read as follows: "Patient feels much better. There is some pain in the left leg, but pain in the lower back has decreased and appetite is much improved." On the ninth and eleventh hospital days, radiation in doses of 200 r was given to the cervical and thoracic spine. Upon completion of this first series, improvement was so striking that opiates were discontinued and there was some return of muscle function in the left leg. A stationary clinical level was reached at four weeks and, therefore, additional dosages of 200 r were administered to the entire spine on the forty-third and forty-fourth hospital days, respectively. The patient was soon walking short distances, but there was still considerable spinal rigidity. The left leg was somewhat ataxic, and acetyl salicylic acid was occasionally needed for lower back pain. A third course of radiation, consisting of only 100 r on subsequent days, was given on the seventy-seventh and seventy-eighth hospital days and, again, there was prompt improvement. In the following two weeks the patient gained four pounds, the gait returned to normal, and all muscle spasm disappeared. In spite of clinical cure, the spinal fluid protein was 456 mg. per 100 c.c. on discharge from the hospital. The highest level obtained was 498 mg. per 100 c.c. There was no significant change in spinal fluid findings immediately following roentgen therapy, nor was the protein level related to the degree of clinical improvement. The patient has now been followed for more than one year and has maintained clinical improvement, although, after nine months the protein level of the spinal fluid was still not normal.

CASE II: J. F. D., a male of two years, was hospitalized on May 9, 1947. He had been entirely well until the preceding day, when he became fretful

and his mother noted some weakness of the legs. On admission physical examination was entirely negative, except for very questionable weakness of both legs. The temperature was 98.8°; pulse rate was normal; urinalysis was negative; a complete blood count was within normal limits. Roentgen examination of the chest, spine, and long bones yielded normal findings. The spinal fluid was clear, with 2 cells per cubic millimeter; glucose was 57 mg. per 100 c.c.. globulin 3 plus (Pandy) and the total protein 114 mg. per 100 c.c.

By the fourth hospital day, there was a complete flaccid paralysis of both legs. The child could no longer sit up and was unable to feed himself. Moderate spinal rigidity had developed, and there was partial paralysis of both arms. Roentgen therapy, 100 r to the entire spine, was given on the thirteenth hospital day. Clinical improvement was obvious within twenty-four hours, with unchanged spinal fluid findings. A week later irradiation was repeated, with the same dosage. On June 3, the spinal fluid cell count was 2 per cu. mm. and the total protein was 142 mg. per 100 c.c. The child was running about the ward, the only abnormality being a waddling type of gait, with the feet held widely separated. He was discharged on June 13, 1947, completely recovered, and has remained well since that time.

SUMMARY

The clinical symptoms of the Guillain-Barré syndrome have been described. Two cases have been reported, one being of the chronic type which had not shown improvement for six months, presenting the picture usually associated with permanent disability as described by McIntyre (7) and De Jong (8). The second case was of the acute type. Both responded so promptly to roentgen therapy that further trial with this type of treatment seems to be warranted.

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SUMARIO

Radioterapia del Síndrome de Guillain-Barré

Al describir los síntomas del síndrome de Guillain-Barré, señálase que el mismo fué primitivamente descrito como afección aguda del sistema nervioso central caracterizada por iniciación súbita y evolución afebril, parálisis flácida afectando los nervios craneales así como periféricos, radiculitis e hiperestesia muscular, con poca o ninguna invasión de los tractos sensoriales, evolución de varias semanas y por fin reposición. Más recientemente se han reconocido otras dos formas de estado: una de evolución prolongada y aparición frecuente de parálisis permanente y otra de desenlace letal debido a parálisis bulbar. La etiología no ha sido esclarecida y no se ha propuesto ninguna terapéutica específica.

Comunícanse dos casos en que se administró la roentgenoterapia al raquis con buenos resultados clínicos. En el primer enfermo el estado había durado seis meses y los hallazgos fueron los asociados habitualmente con incapacidad permanente; el segundo caso en un niño de dos años era de la forma aguda.

Iliac Horns

An Osseous Manifestation of Hereditary Arthrodysplasia Associated with Dystrophy of the Fingernails[1]

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RECENTLY FONG (1) described a bizarre anomaly of the pelvis consisting of processes arising bilaterally from the posterior aspects of the iliac bones. To these bony protuberances he gave the name of "iliac horns." The malformation appears to be unusual, inasmuch as several radiologists and orthopedic surgeons of considerable experience who saw the roentgenograms had never encountered a similar occurrence. From the anatomic standpoint, these processes could not be considered as vestigial structures. In an addendum to Fong's article, Doub (2) stated that he had observed a similar case twenty years earlier. In each of the above instances, the anomaly was asymptomatic and was an incidental finding during the course of a pyelographic study.

It is our impression that iliac horns constitute one of the manifestations of a more complex hereditary syndrome. The following cases are reported in an attempt to justify this assumption.

CASE 1: J. S., a 28-year-old white male, was admitted to Grady Memorial Hospital in November 1946, for pyelographic studies. On physical examination, the thumbnails were found to be absent and the nails of the index finger were divided by longitudinal fissures.

Roentgenologic studies demonstrated hypoplasia of the patellae (Fig. 1), as well as flaring of the iliac bones, from the external surfaces of which oblong processes protruded posteriorly (Fig. 2).

There was a history of absence of the thumbnails and of knee-joint deformities in the patient's mother and maternal grandmother. Similar defects were known to have occurred in two of the mother's sisters and in the patient's brother, two cousins, and a nephew.

CASE 2: B. S., a 5-year-old white boy, a son of the patient described above, was admitted to Grady Memorial Hospital in November 1947, because of hematuria following sulfadiazine therapy for an upper respiratory infection. On physical examination, absence of the thumbnails and deformities of the other fingernails were noted.

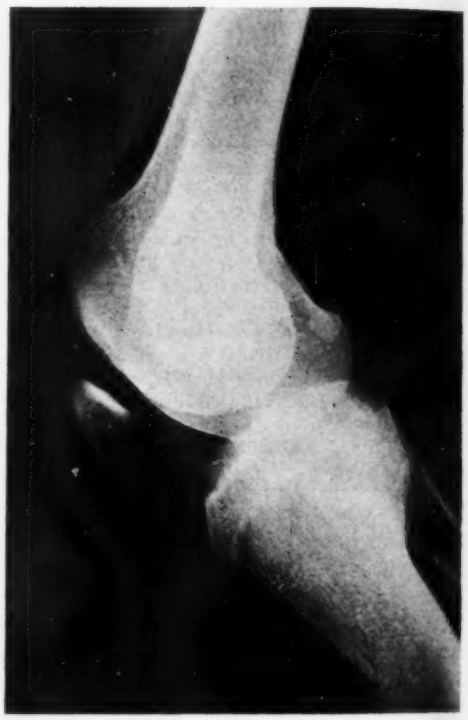


Fig. 1. Case 1. Lateral roentgenogram of knee demonstrating hypoplastic patella. This condition was bilateral.

Pelvic roentgenograms disclosed flaring of the iliac bones and bilateral posterior iliac processes (Fig. 3). The ossification centers for the patellae were not visible.

CASE 3: J. B., a 5-year-old white boy, not related to the patients described above, was admitted to Emory University Hospital for surgical correction of bilateral patellar dislocation. The positive physical findings were referable to the extremities. The

[1] From the Departments of Roentgenology, Emory University School of Medicine, and Grady Memorial Hospital, Atlanta, Ga. Accepted for publication in May 1948.

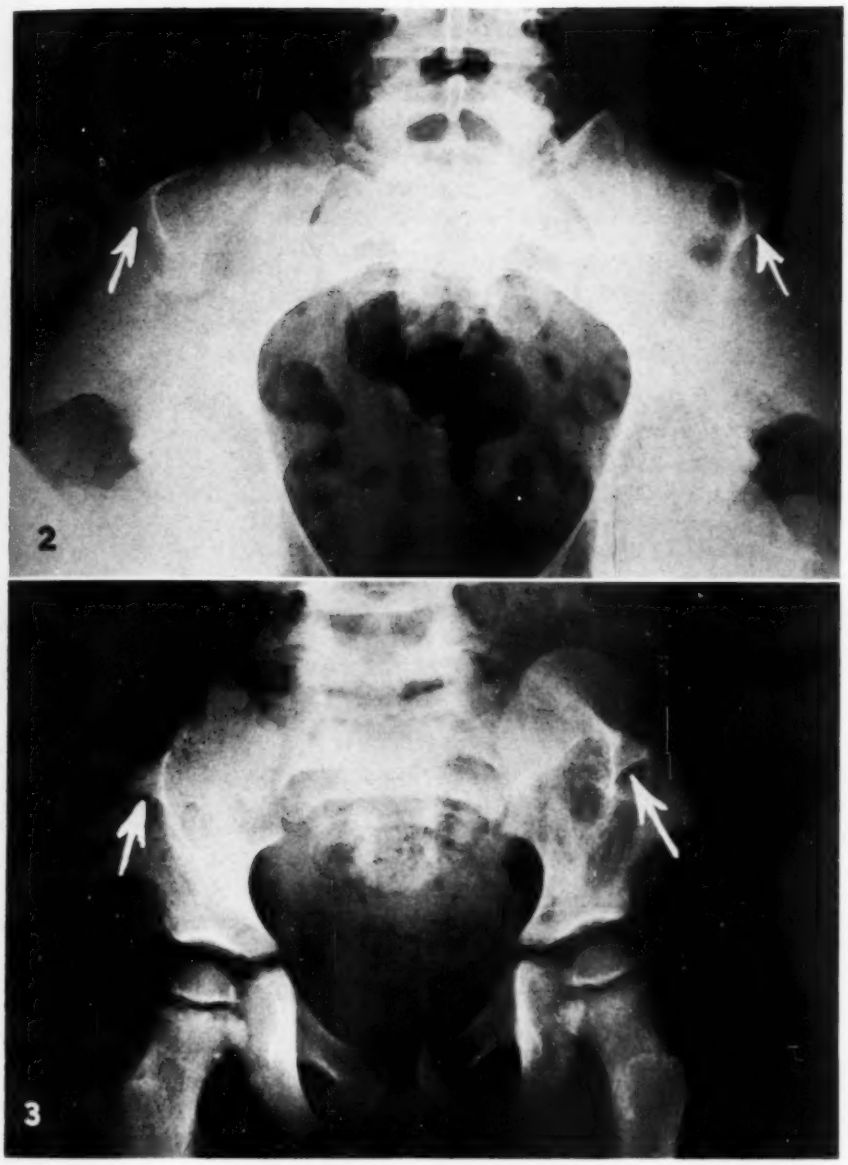


Fig. 2. Case 1. Roentgenogram showing bilateral symmetrical bony protuberances on the posterior aspects of the iliac bones.

Fig. 3. Case 2. Roentgenogram of pelvis showing bilateral iliac horns in a five-year-old boy, son of patient shown in Fig. 2.

upper extremities were normal except for the thumbnails, which showed a central longitudinal ridge and a thin soft distal portion. The patellae were found, on palpation, to be smaller than those normally felt at the age of five and were displaced laterally to a marked degree. The mobility of both knee joints was increased, and the legs could be easily hyperextended.

Roentgenologic examination disclosed shortening of the left radial shaft and bilateral iliac horns (Fig. 4).

The family history of this patient revealed that his

father and a paternal uncle had elbow deformities interfering with flexion and extension of the forearm. One sister who could be examined in our department had bilateral dislocation of hypoplastic patellae and dystrophy of the thumbnails.

CASE 4: L. D., a 53-year-old white woman, not related to the patients described above, was seen in the outpatient department of Grady Memorial Hospital because of abdominal complaints. Physical examination revealed marked underdevelopment of the nails of the thumbs and index fingers (Fig. 5), and absence of the patellae. A questionable abdominal mass was palpable.

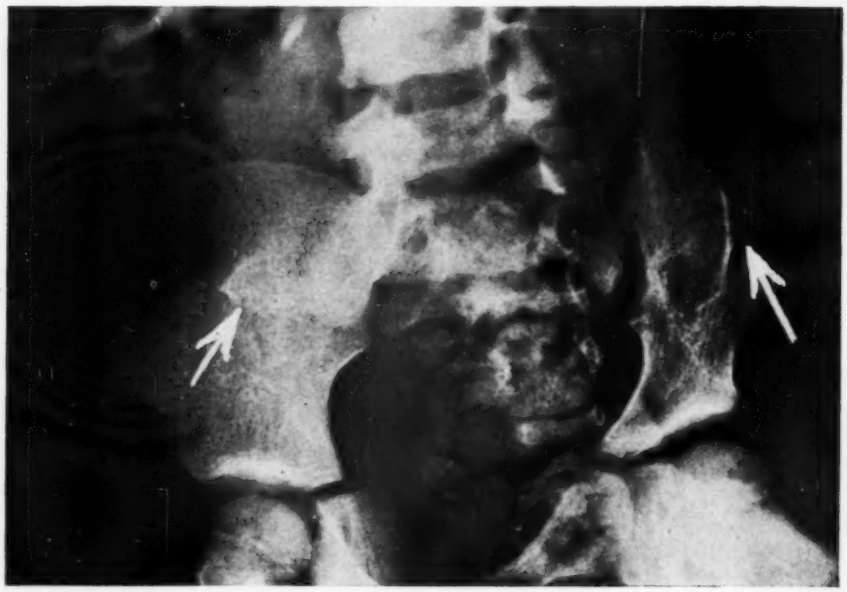


Fig. 4. Case 3. Oblique roentgenogram of pelvis, demonstrating the bilateral iliac horns.

Roentgenograms of the abdomen failed to reveal any pathologic soft-tissue tumors. Symmetrical processes were apparent, however, along the posterior aspects of the iliac bones (Fig. 6). Roentgenograms of the knee joints demonstrated complete absence of both patellae (Fig. 7).

The patient was fully aware of her malformations and stated that several sisters were similarly afflicted.

DISCUSSION

The cases described above demonstrate that iliac horns may occur as a manifestation of a more complex syndrome characterized by fingernail dystrophy and articular malformations affecting predominantly the knee and elbow joints. A description of this condition may be found in a summarizing report by Little (3), who states that Chatelain as early as 1820 was able to recognize this disorder. A detailed discussion of the syndrome will not be attempted here, since an adequate description of its various features may be found in the literature. It may be mentioned, however, that this condition is not sex-linked and is transmitted as a dominant hereditary character. Genetic theories concerning the inheritance of these defects are brought forth in the discussions of Aschner (4) and Montant and Eggermann (5). In recent reports Turner (6), Lester (7), and Senturia and Senturia (8) have described this condition as hereditary arthrodysplasia or familial dyschondroplasia with dystrophy of the nails.

On the basis of our observations, the assumption appears justified that iliac horns may be one of the osseous manifestations of this syndrome. It appears from the literature that abnormalities of the fingernails and absence or hypoplasia of the patellae are the most conspicuous features of the disorder. Defects of the head of the radius, prominence of the acromion and clavicle, underdevelopment of the scapula,

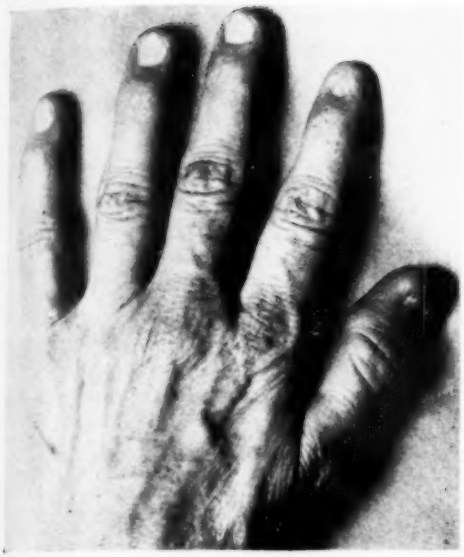
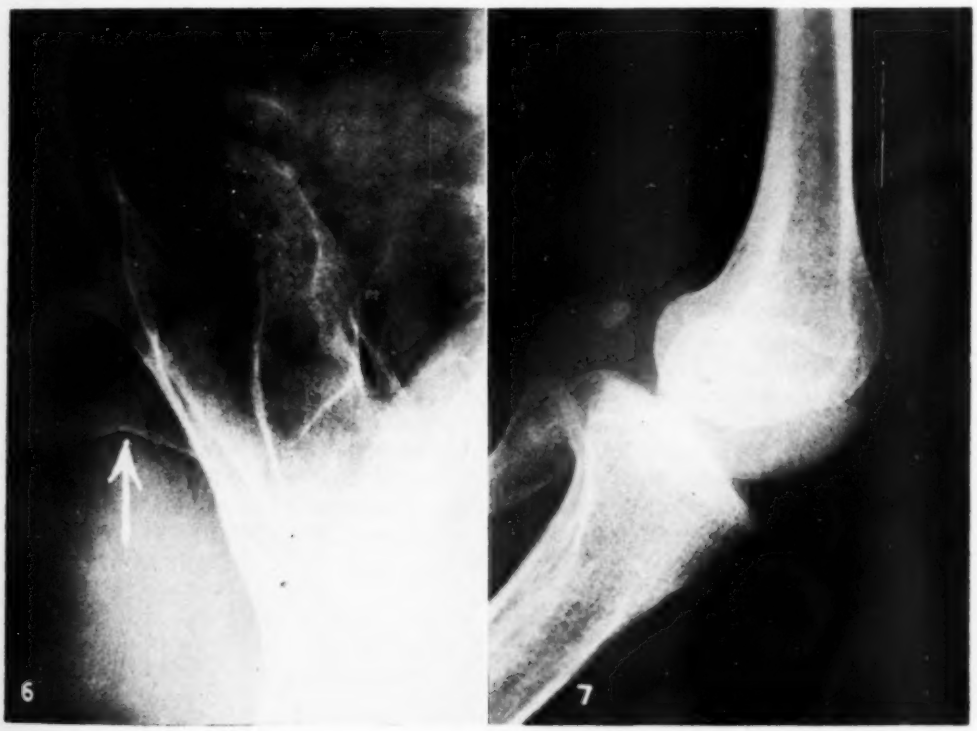


Fig. 5. Case 4. Hand of fifty-three-year-old white woman with marked underdevelopment of the nails of the thumb and index finger.

and discoloration of the iris are other signs less frequently observed.

The literature contains very few references concerning pelvic deformities in patients afflicted with this condition. Turner (6) and Lester (7) stated that there is an increase in the normal concavity of the external surface of the ilium, giving the crest the appearance of an outward flare in its posterior half. No mention is made, however, of osseous processes arising from the posterior surfaces of the iliac bones. Fong (1) should be credited with the description of these protuberances as iliac horns in a patient in whom no other congenital malformations were reported.

An accurate statement cannot be made as to the frequency of occurrence of iliac horns in this syndrome, since complete roentgenologic studies have not been recorded in many instances. We believe that we are able to recognize the presence of



Figs. 6 and 7. Case 4. Oblique view of pelvis, showing to advantage the contour and posterior origin of the iliac horn. Lateral roentgenogram of knee, showing complete absence of patella.

these iliac processes in the pelvic roentgenograms of a case of hereditary arthrodysplasia reported in the literature (6). On the other hand, iliac horns are not a constant feature of this hereditary syndrome. The sister of one of our patients had characteristic patellar and nail malformations, but the pelvis appeared normal on roentgenologic examination.

From a clinical standpoint these bilateral symmetrical bony protuberances appear to be of little importance, as they are asymptomatic. They may be recognized, however, by palpation on physical examination. This malformation is of interest to the roentgenologist, as it suggests to him the search for the other clinically more significant anomalies of this syndrome.

SUMMARY AND CONCLUSIONS

1. Iliac horns are bilateral osseous processes arising from the posterior surface of the iliac bones.

2. Four cases are described in which this pelvic malformation has been found in association with deformity of the joints and faulty development of the fingernails.

3. It appears that iliac horns are not necessarily isolated bony malformations but are manifestations of hereditary arthrodysplasia and fingernail dystrophy.

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SUMARIO

Cuernos Ilíacos: Manifestación Osea de Artrodisplasia Hereditaria, Asociada a Distrofia de las Uñas

Fong Radiology **47:** 517, 1946) y Doub (en un addendum al trabajo de Fong) han descrito una anomalía que consiste en apófisis óseas situadas en las caras anteriores de los huesos ilíacos—los llamados "cuernos ilíacos." Comunícanse ahora cuatro casos en los que un hallazgo semejante se asociaba con anomalías de las uñas de los dedos de la mano y malformaciones articulares que predominaban en las articulaciones del codo y de la rodilla. En todos había antecedentes familiares de anomalías de las uñas y deformidades articulares.

A juzgar por estos datos, parece que los "cuernos ilíacos" no son forzosamente una malformación ósea aislada, pudiendo ser también manifestaciones de artrodisplasia hereditaria y de distrofia de las uñas de los dedos de la mano.

Arteriosclerotic Aneurysm of the Descending Thoracic Aorta Presenting to the Right of the Spine[1]

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ANEURYSMS OF the descending thoracic aorta are the least frequent of intrathoracic aneurysms. These present, characteristically, to the left of the spine and anteroposteriorly, in varying degrees. They may be associated with bony changes in the adjacent thoracic vertebrae and ribs. Often, also, changes in the position of the barium-filled esophagus due to displacement by the aneurysm are present.

In a review of the literature (1–12) 5,636 cases of aortic aneurysm were tabulated by us. Of these, 320 or 5.7 per cent were found in the descending thoracic aorta. The etiology was mentioned in 473 cases, and was syphilitic in 94.3 per cent. Death occurred because of rupture of the aneurysm in an unspecified location in 78 of 995 cases. Seventy-two aneurysms of this latter group were recorded as having occurred in the descending thoracic aorta, but which had ruptured could not be ascertained from the available data. Four ruptured into the right thoracic cavity, but no mention was made as to their site of origin (Table I).

We are reporting here a case of arteriosclerotic aneurysm of the descending thoracic aorta which protruded to the right of the spine and burrowed into the hilus of the right lung. Death followed rupture of the aneurysm. So far as could be determined, the case is unique from the point of view of the location of the aneurysm and its etiology. Others have mentioned the fact that descending thoracic aortic aneurysms may present to the right of the spine (13–16), but we have been unable to find a similar case report complete with radiologic observations and postmortem confirmation.

TABLE I: REVIEW OF LITERATURE

Reference	Cases of Thoracic Aortic Aneurysms	Etiology		Aneurysms of Descending Thoracic Aorta	Death by Rupture	
		Syphilitic	Arteriosclerotic		Number	Site
Boyd (1)	4,000	*	*	156 (3.9%)	*	*
Brindley and Schwab (2)	87	66	8	2 (2.3%)	46	1 right lung
Freedman *et al.* (3)	150	137	13	29 (19.3%)	*	*
Kampmeier (4)	633	*	*	30 (4.7%)	14	2 right lung
Kerley (5)	56	*	*	6 (10.7%)	*	*
Levitt and Ireland (6)	96	*	*	23 (24.0%)	*	*
Levitt and Levy (7)	88	*	*	4 (4.5%)	*	*
Lemann (8)	52	*	*	9 (17.3%)	11	1 right side
Lucke and Rea (9)	223	*	*	31 (13.5%)	7	0 right side
Ogden (10)	112	110	1	20 (17.9%)	*	*
Ruffin *et al.* (11)	66	60	3	8 (12.1%)	*	*
Sichler (12)	73	73	2	2 (2.7%)	*	*
TOTAL	5,636	446	27	320 (5.7%)	78	4 right side

* Data not mentioned in report.

CASE REPORT

A. K., a 54-year-old white man, gave a history of chest pain for seven months. Nine months prior to admission he had had empyema of the left thoracic cavity complicating pneumonia, for which a rib resection had been performed, followed by an uneventful recovery. After discharge from the hospital, he continued, however, to complain of pain over the lower thoracic spine. Two weeks before his present admission he had several hemoptyses of bright red blood soon after arising in the morning. Anorexia and loss of 40 pounds in weight were his other chief complaints.

[1] From the Radiologic Service of M. G. Wasch, M.D., the Jewish Hospital of Brooklyn, Brooklyn, N. Y. Accepted for publication in May 1948.

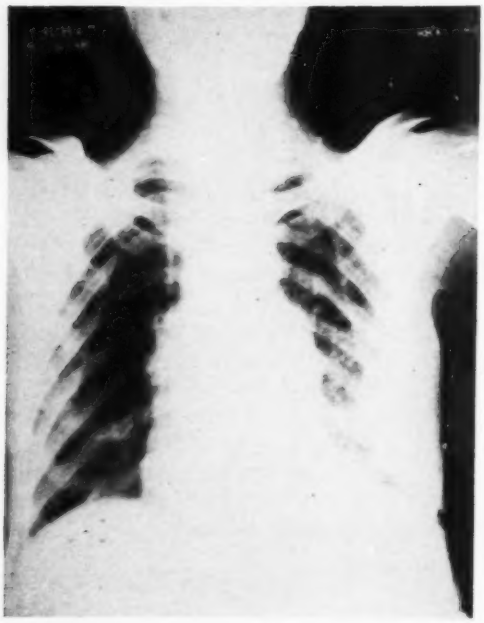

Fig. 1. Teleroentgenogram showing collection of fluid low in the left axillary region. The left lung root is replaced by an opacity indicative of fluid collected here.

Physical examination showed an emaciated, elderly-appearing man who coughed up bright red blood frequently. Moderate tenderness was elicited on percussion over the midthoracic spine. A vertical strip of dullness with diminished breath sounds over the chest was present just to the right of the fifth to the seventh dorsal vertebra, and there was bronchial breathing over the right base. The heart sounds were of fair quality, and a moderately loud, rough systolic murmur was present. The blood pressure was 150/78 mm. Hg. The Wassermann reaction was negative, as it had been on the earlier admission.

During hospitalization the patient frequently expectorated frothy bright red blood. He died on the thirty-fourth day after admission, following an exsanguinating pulmonary hemorrhage.

Radiographic examination of the chest while the patient was under treatment for the left thoracic empyema had revealed an encapsulated collection of fluid in the lower left axillary region (Fig. 1). The left lung root was obscured and it was believed that fluid had also collected there. The heart was not enlarged, and some dilatation of the ascending aorta was present.

Nine months later radiographic re-examination of his chest showed the left lung root to be normal (Fig. 2A). The left axillary fluid collection was no longer visible. A mass could be demonstrated in the right hilus (Fig. 2B) presenting as a rather smooth semicircular convexity. This was diagnosed as a bronchogenic carcinoma. In the lateral projection the mass was seen to occupy the posterior aspect of the right thoracic cavity, presenting a relatively smooth spherical configuration. The barium-filled esophagus was deviated to the left near the mass; in the lateral position a distinct forward impression into the esophagus was demonstrable at the same level (Fig. 2C).

The clinical diagnosis was right bronchogenic carcinoma with extension into the mediastinum.

At postmortem examination the heart weighed 270 gm. The coronary arteries were normal. The ascending aorta contained only a few scattered yellow plaques. Numerous extensive, irregular, firm and soft plaques were present throughout the transverse and descending thoracic aorta, and between these the intima presented a "tree-bark" appearance. At the level of the sixth thoracic vertebra the aorta was firmly attached to the spine, so that on removal of the thoracic organs this segment of the aorta had to be left *in situ*. A shallow depression was present in the body of the sixth thoracic vertebra. Immediately adjacent to this, the aorta communicated through an opening 4 cm. in diameter with an aneurysm which had excavated into the lower lobe of the right lung, producing a cavity filled with clotted blood (Fig. 3). The left lateral wall of the aorta was firmly attached to the hilus of the left lung. The esophagus was displaced forward and to the left.

The right lung, which weighed approximately 1,000 gm., presented on cut section a well circumscribed cavity about 6 cm. in diameter. The bronchi and alveoli were plugged with blood clots.

On microscopic examination, the intima of the aorta was thickened and contained many elongated slit-like spaces within which occasional spindle-shaped cells were present. In places, the intima was elevated in a plateau-like manner, and between the intima and the media were large deposits of light pink- and lavender-staining amorphous material. The continuity of the muscle fibers was interrupted and distorted.

The final diagnosis was arteriosclerotic aneurysm of the descending thoracic aorta with perforation into the right lung.

SUMMARY

Extension of an aneurysm of the descending thoracic aorta to the right is most unusual. In the case reported hilar bronchogenic carcinoma had been considered because of the location, and it was not until postmortem examination that the diagnosis was clarified. The history of

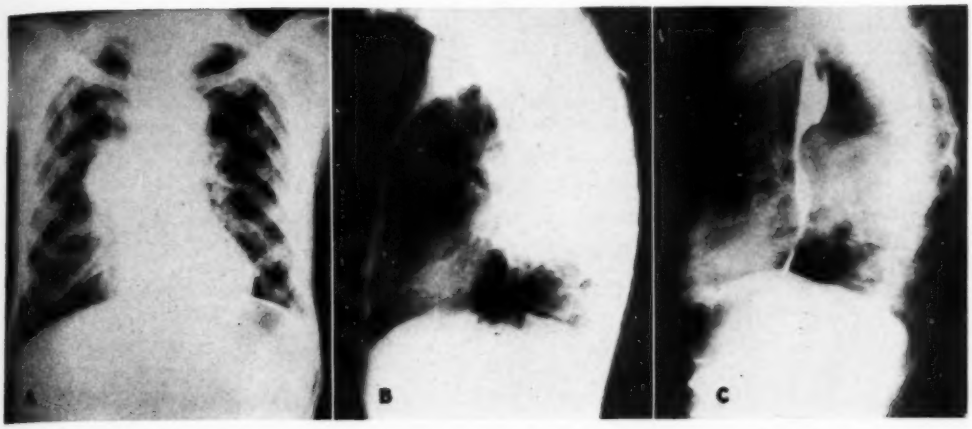

Fig. 2. A. Teleroentgenogram made nine months after that reproduced in Fig. 1. The axillary encapsulated fluid is gone, and a mass is seen in the right lung root. B. Lateral teleroentgenogram showing a circular mass in the posterior aspect of the right lung. C. Right lateral roentgenogram showing forward impression of the mass into the barium-filled esophagus.

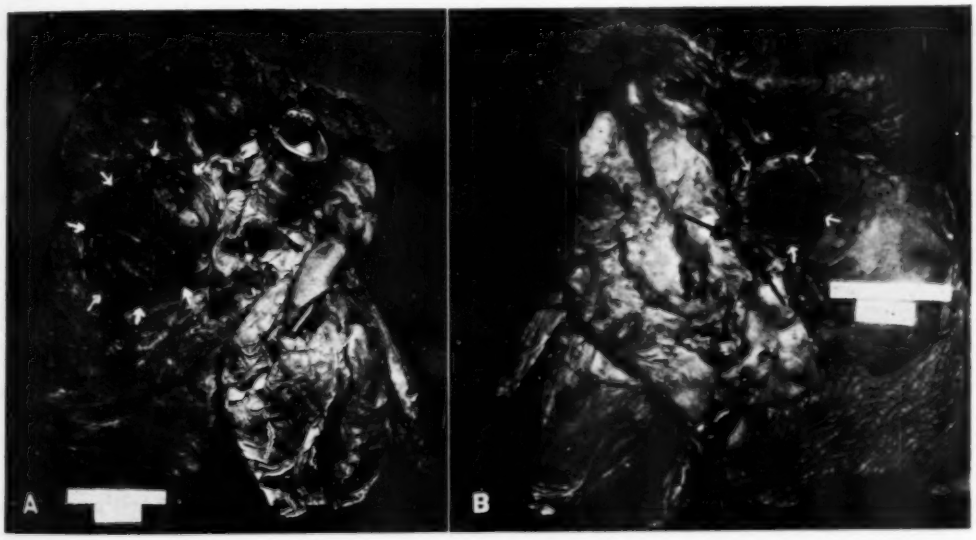

Fig. 3. A. Photograph of specimen showing excavation into the right lower lobe filled with blood. B. Same specimen with the aorta opened, showing communication between the aorta and the aneurysm.

repeated frothy hemoptyses may well have suggested the possibility of an aneurysm. The negative blood Wassermann reaction tended to confuse the issue, even though it was recognized that aneurysms in the aged not infrequently are arteriosclerotic in origin. The deviation of the barium-filled esophagus to the left and anteriorly was due to the aneurysm, but our interpretation had been mediastinal metastases from a bronchogenic carcinoma.

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SUMARIO

Aneurisma Arterioesclerótico de la Aorta Torácica Descendente Apuntando a la Derecha del Raquis

Comunícase un caso de aneurisma arterioesclerótico de la aorta torácica descendente que sobresalía a la derecha de la espina dorsal y horadaba en el hilio del pulmón derecho.

La expansión de los aneurismas de la aorta torácica descendente tiene lugar típicamente hacia la izquierda del raquis. En el caso ahora comunicado, la peculiar localización condujo a un diagnóstico de carcinoma broncógeno hiliar. La desviación del esófago, lleno de bario, hacia la izquierda y el frente, observable radiográficamente, y en realidad debida al aneurisma, fué imputada a metástasis mediastínicas. Otro factor que acrecentó la confusión fué una Wassermann repetidamente negativa, dado que unos 90 a 95 por ciento de los aneurismas aórticos reconocen etiología sifilítica.

El enfermo falleció consecutivamente a la rotura del aneurisma.

An Accessory Bone and Other Bilateral Skeletal Anomalies of the Elbow[1]

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and

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TRUE ACCESSORY bones of the elbow have not been established with certainty (1). Separate ossicles have been reported in relation to the olecranon fossa, to the medial or lateral epicondyles, and to the coronoid fossa. In the first situation they are interpreted to be either sesamoid bones associated with the tendon of the triceps brachii or the ununited epiphysis of the olecranon process of the ulna. In the other positions they have been considered to be the result of ossific centers avulsed at an early age or parts of the normal bones separated by trauma. In each of these conditions there are resultant defects in the skeleton of the elbow (2). Wülfing (1) and Zeitlin (3) are among those who consider the presence of an accessory bone of the elbow to be invariably the result of trauma. Rarely has the bone been removed for histologic study (3).

The elbows of a 65-year-old Negro male cadaver were conspicuous on the dissecting table because the joints were in semiflexion and resisted extension beyond 135°. Flexion, however, was normal in extent, being limited only by the soft parts. After removal of the skin and dissection of the soft parts (which showed no abnormality) but with the articular capsules intact, roentgenograms were made. Each elbow presents an anomalous bone lying anterior to the joint and apparently articulating with the ulna and humerus. In addition, in each roentgenogram there is seen an unusually long olecranon process of the ulna impinging on a thick transverse bar of bone within the olecranon fossa of

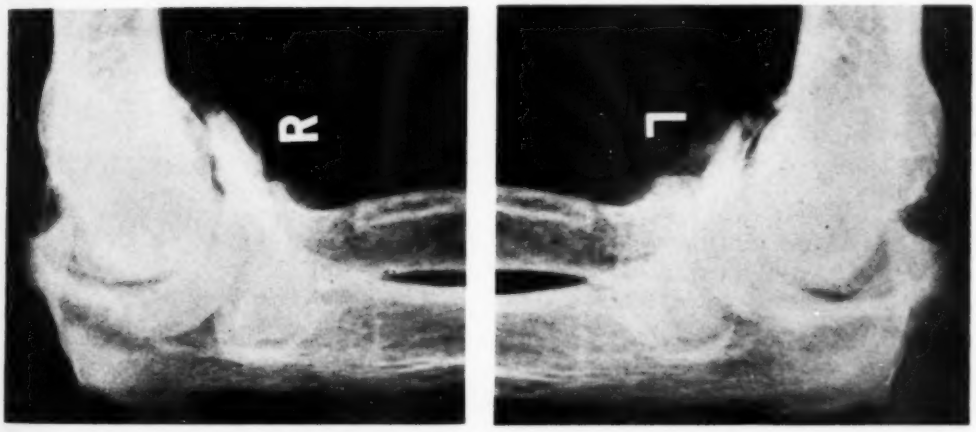

Fig. 1. Roentgenograms of both elbows (lateral view) exposed prior to removal of the articular capsules. Note the anomalous bone immediately adjacent to the letter indicating the side of the body and partially overlying the coronoid process of the ulna deep to the capsule; also, the long olecranon process and the variations involving the olecranon fossa.

[1] Demonstrated at the Sixty-first Session of the American Association of Anatomists, 1948. Paper accepted for publication in June 1948.

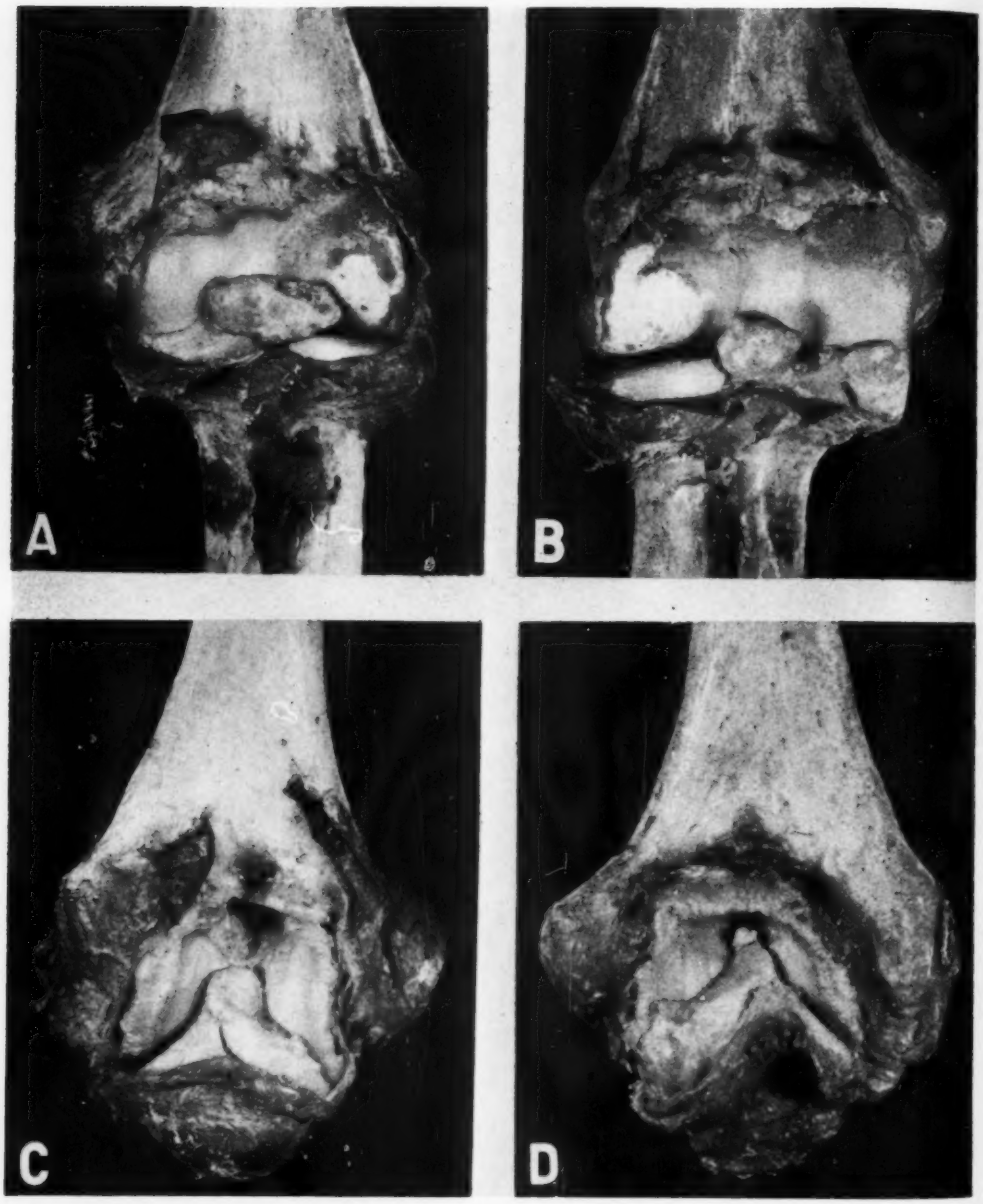

Fig. 2. Photographs of both elbows after the articular capsules were opened. A and B. Left and right, anterior views, respectively, showing the anomalous bone of each *in situ*. Erosion of the articular cartilage and arthritic osteophytes on the articular margins may be seen (particularly on the ulna and humerus). C and D. Left and right posterior views, respectively, showing a long, narrow olecranon process and the olecranon fossa presenting a transverse ridge of bone.

the humerus (Fig. 1). There is roentgenological evidence, also, of hypertrophic (degenerative) arthritic changes in the bones of the elbows.

Reflection of the anterior portion of the articular capsule exposes the anomalous bone, verifies its intracapsular position, and further indicates complete freedom

from the capsule. These findings eliminate its classification as a sesamoid bone, since it was neither embedded in the capsular ligament nor intimately associated with a related tendon. On the left limb (Fig. 2A) the bone measures 2.4 cm. in its transverse axis and 6 mm. in its anteroposterior dimension. It is located approximately in the center of the anterior surface of the joint and articulates with the anteromedial border of the head of the radius, with the lateral border of the coronoid process of the ulna, with the capitulum and anterior portion of the trochlea of the humerus lateral to its constriction. A short ligament extending from the distal aspect of the anomalous bone to the anterior border of the radial notch of the ulna at the margin of the articular capsule provides the only attachment. In the right elbow (Fig. 2B) the bone is slightly smaller (1.4 cm. by 8 mm.) but similar in position, articulations, and attachment. The right upper extremity is slightly larger than the left in all other respects. "Anterior bone of the elbow (os cubiti anterius)" is suggested as a suitable name for these anomalous bones. Both elbows show evidence of arthritic change, manifested by erosion of the articular cartilage of the capitulum, eburnation of the capitulum, and by lipping and spurring of the articular margins of the bones. The change in the articular cartilage of the anomalous bones and in the contiguous articular cartilages is limited to fraying. The ulna and humerus show a greater degree of change than the radius.

As noted above, all previously reported cases of accessory bones of the elbow have been considered to be traumatic in origin, and histopathologic studies of their nature are rare. Microscopic sections were made of the left anomalous bone, of an arthritic osteophyte of the left humerus, and of the pisiform bone of the left hand. They were prepared with Mallory's trichrome stain. The slides were examined by Dr. David E. Smith, of the Department of Pathology of Washington University, who reports that the anomalous bone is composed of true, mature, viable bone. There are arthritic changes evidenced by fraying of the articular cartilage and by extension of subchondral bone into the cartilaginous matrix (Fig. 3). Bennett, Waine, and Bauer (4) list the latter condition as a not infrequent microscopic finding in early hypertrophic arthritis. No resemblance to either the loose bodies of osteochondritis dissecans or other clinical entities resulting in "joint mice" is noted microscopically. The microscopic appearance of the arthritic osteophyte is typical, being characterized by erosion of cartilage, thinned trabeculae, and piling-up of bone which may be interpreted as an attempt at regeneration. The pisiform bone presents the usual appearance of unaffected adult bone.

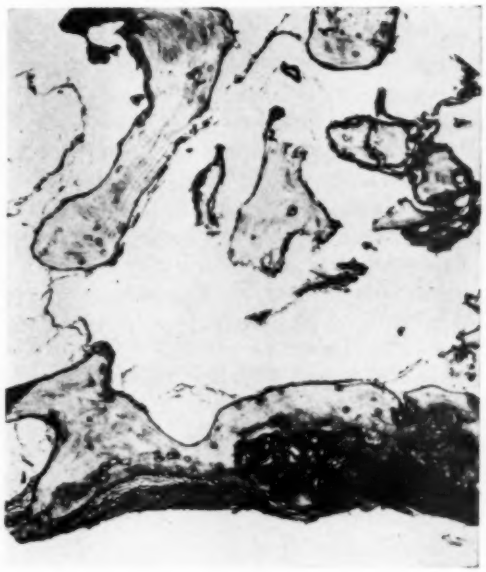

Fig. 3. Photomicrograph of a cross section of the left accessory bone (× *c*.65). Note the normal trabeculae at the top of the figure, frayed cartilage and extension of subchondral bone into cartilage on the observer's right.

Reflection of the posterior portion of the left articular capsule (Fig. 2C) reveals the long olecranon process noted above and the transverse ridge of bone involving the olecranon fossa. The transverse ridge divides the fossa into two portions, the more distal and larger of which receives the olecranon process. The entire olec-

ranon fossa with its transverse ridge of bone and the olecranon process is intracapsular. The right elbow (Fig. 2D) presents a similar condition.

It is further noted on the gross specimen and in the roentgenograms that there is no defect in the radius, ulna, or humerus of either elbow. This finding reduces the possibility of traumatic origin of the accessory bones.

The past history of this individual is irrelevant except for the fact that he was a common laborer in quarries, a flour mill, and in connection with a steam motor, presumably as a fireman. The occupational history, combined with the deformity of both elbows limiting extension, helps to explain the relatively great degree of arthritic change in the elbows as compared to the other joints of the body.

This is not meant to imply that the other joints of this cadaver are free of arthritic changes. The entire spine shows a moderate degree of spurring of the bodies of vertebrae, but arthritic changes are noted in the joints between the articular processes of the vertebrae only in the lumbar region. Severe changes are present in the sacroiliac joints with fusion bilaterally in the superior portion. Minimal to moderate arthritic changes are present in the knee, ankle, and shoulder joints. Both acromioclavicular joints show a greater degree of change than is ordinarily seen in this joint, suggesting some correlation with the anomalies of the elbows.

Comroe (5) states that the elbow is usually one of the last joints to be involved even in advanced cases of generalized hypertrophic arthritis. It is thought that the relatively great arthritic changes in the elbow of this cadaver are the result, at least in part, of trauma induced by the posterior anomalies and the resulting limitation of extension, inasmuch as the elbow is not as commonly the site of hypertrophic arthritic changes as other joints.

SUMMARY

A case of bilateral true accessory bone of the elbow is reported. Gross, microscopic, and roentgenographic evidence support this interpretation. The name, "os cubiti anterius" is suggested for the anomalous bone.

A second bilateral anomaly in the form of a transverse ridge of bone in the olecranon fossa and a long olecranon process is described.

NOTE: A personal communication from Dr. Edward A. Holyoke, Professor of Anatomy, University of Nebraska, has verified a comment he made during the meetings of the Sixty-first Session of the American Association of Anatomists, in April 1948. Dr. Holyoke stated at the time that he had seen a similar case in his laboratory in 1947. A check of his records has verified his impression. The case, interestingly enough, was also in a Negro male.

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SUMARIO

Hueso Accesorio y Otras Anomalías Esqueléticas Bilaterales del Codo

En un caso de verdadero hueso accesorio bilateral del codo, se observaron los huesos accesorios radiográficamente en el cadáver de un negro. Los hallazgos roentgenológicos fueron confirmados por el estudio de la anatomía macroscópica, y de los cortes microscópicos. Para esta anomalía propónese el nombre de "os cubiti anterius."

En el mismo caso existía además otra anomalía bilateral en forma de un surco transversal de hueso en la fosa del olécranon y una apófisis olecraniana larga.

Effect of Roentgen Therapy on Mouse Encephalitis[1]

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SINCE 1929, INVESTIGATORS have reported varying degrees of success in treating acute encephalitis and poliomyelitis with x-rays (1–6). In spite of claims for high beneficial results, it has been pointed out (7) that there is much difficulty in evaluating any treatment of acute diseases which, if they do not lead to death, usually result in recovery.

Only two records of controlled animal studies were found (8, 9). Goldberg *et al.* (8) reported on the effect of x-ray therapy on mice experimentally inoculated with St. Louis encephalitis virus. In mice inoculated intranasally, the results were striking, but in animals inoculated by intracerebral injection, there was no appreciable difference in survival between the treated mice and the infected controls.

EXPERIMENTAL METHODS

Virus: A pool of Theiler's FA mouse encephalitis virus[2] was obtained by passage of glycerinated mouse brain extracts into 48 CFW mice.[3] The mice were sacrificed as soon as they showed clinical symptoms of encephalitis. Their brains were removed and ground in a mortar, with sterile alundum as an abrasive. Sterile saline was added and a 20 per cent emulsion was prepared. The emulsion was centrifuged for ten minutes at 1500 r.p.m. The supernatant fluid was decanted, mixed, and placed in 1.0-c.c. vials. The vials were sealed and placed in a deep-freeze chamber (−70° C.).

Roentgen Therapy: In order to limit irradiation to the skull, a simple technic was used. Glass test tubes were cut to a desired length (8.0 cm.). A hole (2.0 cm. in diameter) was made near the closed end of each tube. Scotch tape was placed over the opening, and the remainder of the tube was wrapped with lead foil. The mice were placed in the tubes and cork stoppers adjusted behind them so that only the heads were exposed to radiation through the tape-covered hole. The exact dosage was determined by inserting a Victoreen ionization chamber into the tube beneath the covered portal.

Total body irradiation was attained by placing the animals in a low cloth-covered box and allowing them to run at will beneath the x-ray beam.

Effect of X-rays upon Mice: To determine the toxic effect of the x-rays upon mice, groups of six-week-old mice were subjected to 50 r daily over the entire body for six days, 200 r daily to the head only for three days, and 100 r over the head only for six days. The factors were 90 kv.p., 7 ma., 16 inches distance, and 2.0 mm. Al filtration; half-value layer 2.25 mm. Al.

Thirty-two mice were used in the above series: 6 died of a diffuse pneumonitis that was demonstrated at autopsy. Deaths occurred at irregular intervals and were not related to dosage of x-rays. One mouse died of unknown causes on the twenty-sixth day. None of the fatalities could be attributed to radiation.

RESULTS

Titration of Virus: The results of titration of the FA strain of mouse encephalitis virus appear in Table I. The LD 50 dose was contained in 0.03 c.c. of a 10^{-8} dilution of virus.

Effect of X-rays on Infected Mice: (a) 100 MLD: Five groups of 16 mice each were inoculated with 100 LD 50 doses of

[1] From the Departments of Pediatrics and Radiology and the Hixon Memorial Laboratory, University of Kansas Medical Center, Kansas City, Kan., aided by a grant from the National Foundation for Infantile Paralysis, Inc. Accepted for publication in May 1948.
[2] We are indebted to Dr. M. Theiler for sending us this strain of virus.
[3] CFW strain of mice, Carworth Farms, New City, N. Y.

TABLE I: TITRATION OF FA STRAIN OF MOUSE ENCEPHALITIS VIRUS

Virus Dilution	No. Mice	No. Mice Dead (Days After Inoculation)														Ratio of Dead to Survivors	Average Survival (Days)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		
10^{-2}	8	..	..	..	1	..	3	2	2	..	..	..	..	..	..	8/0	6.5
10^{-3}	8	..	..	..	..	1	3	1	2	..	1	..	..	..	..	8/0	7.0
10^{-4}	8	..	..	..	..	2	..	..	2	2	2	..	..	..	..	8/0	8.2
10^{-5}	7	..	..	..	..	2	..	..	..	2	1	..	1	1	..	7/0	8.9
10^{-6}	7*	..	..	..	..	..	..	1	1	..	3	1	1	..	..	7/0	9.7
10^{-7}	8	..	..	..	..	..	..	..	..	3	..	1	1	2	1	8/0	11.2
10^{-8}	7*	..	..	..	..	..	..	..	..	..	1	1	..	2	..	4/3	...

* One mouse died as result of inoculation intracerebrally.

FA virus. Each group was then subjected to a constant x-ray dose (50–200 r) to a given portal for a defined period of time (Table II).

Observations made on the incubation period (Table I) using decimal dilution of virus indicated that with 100 LD 50 doses symptoms appeared between the seventh and twelfth days. Hence, two groups of mice were irradiated (50–100 r) daily during the first six days following inoculation with virus, and three groups during the period (six to eleven days) when symptoms were expected to appear.

The results of these tests and pertinent data regarding x-ray dose, portal, and interval of irradiation appear in Table II. In terms of mortality rate, or indeed of survival time, no significant differences were observed among the several groups of irradiated animals. Neither was there any appreciable difference between control and irradiated mice.

TABLE II: EFFECT OF X-RAYS ON MICE INFECTED WITH FA STRAIN OF MOUSE ENCEPHALITIS VIRUS (100 LD 50 DOSES)

Dosage (*r*)	Portal	Dilution Virus	Radiation Period (Days After Inoculation)	No. of Mice	Ratio of Dead to Survivors	Per Cent Survivors
50	Entire body	10^{-6}	1st through 6th	16	14/2	12.5
100	Head	10^{-6}	1st through 6th	14	11/3	21.4
100	Head	10^{-6}	6th through 11th	16	15/1	6.2
200	Head	10^{-6}	6th through 8th	15	13/2	13.5
50	Entire body	10^{-6}	6th through 11th	16	13/3	18.7
0	...	10^{-5}	Control	8	8/0	0
0	...	10^{-6}	Control	8	7/1	12.5
0	...	10^{-7}	Control	8	7/1	12.5

(*b*) *10 MLD:* In order to be certain that the dosage of virus employed above did not represent too severe a test, a similar experiment with 10 LD 50 doses of virus was completed. The results appear

TABLE III: EFFECT OF X-RAYS ON MICE INFECTED WITH FA STRAIN OF MOUSE ENCEPHALITIS VIRUS (10 LD 50 DOSES)

Dosage (*r*)	Portal	Dilution Virus	Radiation Period (Days After Inoculation)	No. of Mice	Ratio of Dead to Survivors	Per Cent Survivors
50	Entire body	10^{-7}	1st through 6th	16	14/2	12.5
50	Entire body	10^{-7}	7th through 12th	16	16/0	0
100	Head	10^{-7}	1st through 6th	15	14/0	...
100	Head	10^{-7}	7th through 12th	16	15/1	6.2
100	Head	10^{-7}	Every 2nd day for 6 doses from 1st day	8	6/2	25.0
...	...	10^{-7}	.....	16	12/4	25.0
...	...	10^{-8}	.....	8	6/2	25.0

NOTE: All deaths in first twelve hours are discounted.

in Table III. As compared with the controls, the irradiated mice had a higher mortality rate, but the difference is not beyond that due to chance. At best, a therapeutic response in mice could not be demonstrated, although irradiation was carried out during the incubation and prodromal periods of illness.

SUMMARY

Five groups of mice, inoculated intracerebrally with approximately 100 LD 50 FA (Theiler's) mouse encephalitis virus, were treated with x-rays in various doses. There was no significant difference in the percentage survival rate or the clinical course between these treated animals and the infected controls.

In a second series of five groups of mice inoculated with approximately 10 LD 50 the results were nearly identical.

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SUMARIO

Efecto de la Roentgenoterapia sobre la Encefalitis Murina

Cinco grupos de ratones, inoculados intracerebralmente con unas 100 D.L.50 de virus de la encefalitis murina (Theiler) FA, fueron tratados con rayos X a varias dosis. No se observó mayor diferencia en el coeficiente porcentario de sobrevivencias o en la evolución clínica entre los animales tratados y los testigos infectados.

En otra serie de cinco grupos de ratones inoculados con unas 10 D.L.50, los resultados fueron casi idénticos.

Véanse las Tablas II y III.

Psychological Factors in Atomic Warfare[1]

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MANY OF THE IDEAS I want to discuss are matters of opinion—and they are, in some cases, ideas on which the diversity of opinion seems to be a function of the number of people having the ideas. I want to present my ideas with the hope of stimulating thought and more careful consideration of a most important problem.

Please do not interpret any of my remarks as indicating anything less than the fullest respect for the phenomenon of radioactivity as a diabolical instrument of death and injury to men. I only want to point out that we are justified in taking a rather hardboiled attitude toward it. Since we have no choice but to live with it, we must keep it in proper perspective.

Since the advent of nuclear explosives in the so-called atom bomb, with its attendant ionizing radiations in massive amounts, unfortunate psychological reactions have developed in the minds of both the military and civilians. This reaction is one of intense fear, directed against forces that cannot be seen, felt, or otherwise sensed. I have observed the reactions of the military, who were not acquainted with the technical details, on two missions, Bikini and Eniwetok, and the fear reaction of the uninitiated is appalling. The fear reaction of the uninitiated civilian is ever evident. It is of such magnitude that it could well interfere with an important military mission in time of war.

The effect of ionizing radiation upon living cells is detrimental. It must be realized, however, that nature has been constantly bombarding the populations of the world with ionizing radiation since the formation of the universe, by constant exposure to cosmic radiations and to radiations emanating from natural radioactive elements, such as radon and thoron.

This kind of injury must be considered, not standing by itself, but in connection with the total situation, *i.e.*, weighed in relation to the objectives in view, both in regard to their importance under the circumstances and their probability of attainment. Unless we can thus integrate it with our whole philosophy of national defense, the atom bomb can prove a liability rather than an asset.

With the publicity incident to the atom bomb, the term "roentgen" has become a household word. It is a term of physical measurement, such as "centimeter" or "gram." It is based upon one of the physical effects of certain types of electromagnetic waves that cannot be measured with a yardstick. The large step from such a physical measurement to expected biological behavior in human beings is based upon experimentation on lower animals, empirical observations, and clinical investigations. There are, however, many blank spaces in our experience, and many superstitions have been introduced. Since it is impossible to stipulate all conditions of experimentation and observation in most of the articles written about radiation for lay consumption, an idea has evolved in many minds that any and all radiation exposure will cause immediate and mysterious injury or death. This reasoning is fallacious, but it is also attractive and has become contagious.

The problem of radiation injury is not one which can be easily simplified. In fact, over-simplification may be the cause of a situation such as we are combating at this time. It seems desirable to explore radiation hazards more fully in relation to other hazards which are considered more common and acceptable.

The permissible radiation dose is 0.2

[1] Presented at the Thirty-Fourth Annual Meeting of the Radiological Society of North America, San Francisco, Calif., Dec. 5–10, 1948.

or 0.1 r per day, or 0.3 r per week, according to your authority. This should no longer be called the "tolerance dose," for no amount of radiation should be tolerated without good reason. One is willing, however, to name a dose so small that a person might be exposed to it every day of his life and suffer no observable injury or shortening of the life span.

When one is dealing with radiation technicians or with industrial workers who are exposed to this hazard daily, one can easily see how the maintenance of exposures at or below this level is a very desirable thing. Day-by-day contact with radiation or radioactive materials demands that a low limit of exposure be adhered to, if late complications of such chronic trauma are to be avoided. Similar occupational hazards exist in all branches of production—as the inhalation of noxious gases and dust to the coal miner, the steel worker, and the chemical worker. It has been known for years that if a miner is subjected to small amounts of dust containing silica he eventually will develop silicosis, frequently complicated by tuberculosis, with a fatal termination. For this reason, methods of counting and analyzing dust have been perfected, and forced ventilation systems have been established to minimize the danger. This does not mean that, if an individual makes a one-day visit to a mine and inhales 100 times the daily minimal allowance for miners, he will develop silicosis. The tolerance limit in this instance has nothing in its definition which refers to acute exposure. Neither is the 0.1 r per day tolerance limit related to acute exposure to radiation.

The total body dose of radiation received in an acute exposure is known from therapeutic experience to vary with the patient. This and the lethal dose for man have not received the same attention from rule-making bodies that the "permissible dose" has had. We may take 450 r as the median lethal dose.

Going further down the scale, one may consider a limit of 200 r, which may cause radiation sickness in 50 per cent of human subjects when delivered, as an acute dose of total body radiation. Since some subjects may be relatively sensitive to radiation and others relatively resistant, it is difficult to calculate the precise effects to be expected.

It is not unusual to subject a patient to multiple x-ray studies of the skull, spine, long bones, gastro-intestinal tract, kidneys, sinuses, etc., in a relatively short space of time, thus subjecting him to a dose of radiation which may well approach 25 r. These procedures are not done without purpose, and the benefit derived from them outweighs all fear as to the possible injury from radiation. Full-body irradiation in doses of the order of 25 to 100 r has been given to patients for treatment of various conditions. Again these exposures are prescribed for a purpose which outweighs the fear of radiation injury.

As stated above, it is not my purpose to underestimate or understate the radiation hazard, but from a military standpoint the physical danger must be evaluated against the objective to be gained.

War is fought with the knowledge that men will be killed. Campaigns are planned with the expectation of losing so many thousand men. If this is regarded as an "acceptable hazard," then it is obviously not wise to treat radiation hazards very differently. If other military hazards will be lessened by acceptance of the radiation hazard, then it should be accepted. This can only be done, however, if the attitude of the men exposed is psychologically similar toward the two types of hazard. If they are going to be as much terrified by the knowledge that a recent atom bomb explosion has contaminated the ground they are walking over as they would be by seeing one in ten of their buddies fall by machine-gun fire, one cannot apply the "ideal" solution. What is dominant for actual percentage survival is the resultant of all the actual hazards. But for battle discipline and military effectiveness, the dominant measure is not the hazard itself but the soldiers' estimation of the hazard.

Men at war suffer many hazards, acute

and chronic, besides bullets: malaria, venereal disease, exposure to cold and wet, starvation, etc. Some of these, *e.g.*, venereal disease, are underevaluated by the doughboy while others, as filariasis, are grossly overevaluated. At present radiation is perhaps the most overevaluated of all, partly due to our great care in Operations Crossroads. That operation was conducted at the peacetime level of safety to personnel. Unless we had openly proclaimed immediate danger of war, the military level for hazardous training programs, such as we had actually adopted during the war, using live grenades and live ammunition in the machine guns, was not tolerable at Bikini. It must be emphasized that hazards acceptable in a peacetime operation cannot be adhered to in wartime.

Psychological training for the military level of acceptable radiation hazard is possible and should be prosecuted, even though operation field training does not permit this to be accomplished at the present time.

We hear much about sterility as a result of exposure to ionizing radiation. It must be borne in mind that sterility results only from a large dose of acute radiation, or from smaller doses over a long period of time, a matter of years. Sterility also results from other accepted hazards encountered in war, notably venereal disease. We are aware of hundreds of paraplegias due to spinal fractures, gunshot wounds of the cord, etc., during the last war, resulting not only in sterility but impotence. Leukemia may be another late result in casualties from repeated radiation, but amebic dysentery and schistosomiasis carry a great delayed hazard, as does beriberi, which was so prevalent among our prisoners-of-war.

I have knowledge of a death at Bikini caused by drinking wood alcohol. There were other deaths due to various types of accidents. At Eniwetok we had a death due to drowning; one due to a truck accident, and one due to a fracture of the skull encountered in a fight. A sailor sustained a fracture of the cervical spine with severance of the cord by diving into shallow water. He will be paralyzed, sterile, and impotent as long as he lives. None of the above tragic episodes received national news publicity. However, had we had a single death due to radiation, would it have been publicized? It would have received front page publicity throughout the country.

During August of 1946, I interviewed and examined a large number of Japanese who had recovered from radiation sickness. They appeared perfectly normal and were handicapped in no way toward pursuing their manner of living. Such is not the case with thousands of our soldiers who participated in "conventional" warfare in World War II. They are handicapped by loss of limbs and eyes. Neither is it true of many of the Japanese who received no radiation injury but suffered severe burns and traumatic injury as a result of the bombing. It has been estimated that from 5 to 15 per cent of the deaths at Hiroshima and Nagasaki were due to radiation. Why do we concentrate on the 15 per cent and forget the 85 per cent?

The atomic bomb was developed as a blast weapon of war and strategically so used. The radiation effect was never considered to be the prime component of its effectiveness. The destruction attendant upon the blast, heat, and secondary fires was paramount. In Japan there was no significant "poisoning" of the ground by fission products or induced activity from neutron capture; yet many believe that the bomb is primarily a weapon which destroys by mysterious radioactivity.

I have appeared before local defense agencies in many of our cities. They are preparing for defense against an atomic bomb attack, and universally they are thinking only of radiation. Invariably they ask: "Where will we get Geiger counters?" Geiger counters are not the only problem. Fire-fighting equipment is many times more important, as are well organized rescue squads. "But we have been told that we will not be able to go into a bombed city and rescue the injured."

Hiroshima and Nagasaki disprove this. The residual radiation from an air burst bomb is insignificant. The significant radiation occurs in a matter of microseconds and does not extend beyond a 2,000 yard radius. Immediately after a detonation such as occurred at Hiroshima or Nagasaki, it is perfectly safe to enter into a bombed area and rescue the thousands whose injuries will be such that they will not be able to walk. Unless evacuation of these injured is effected, thousands will be burned to death by secondary fires. Such was the case at Hiroshima and Nagasaki. But how about an underwater or ground burst? In such cases certainly the residual radiation hazards would be increased many fold, but the blast and fire hazards and the prompt radiation hazard would be proportionately decreased, and in my opinion, the total number of casualties would be less.

Much has been written about "poisoned" water. In case the water supply of a city is contaminated by fission products or unfissioned material from an air burst of an atomic bomb, all the evidence on hand at present indicates that, after passing through a modern filtration plant, the water at the tap would be safe to drink. More work will be done to prove or disprove this statement. We do know, from our experience at Bikini, that the water from evaporators used on the ship is safe for drinking. Again we must not forget that frequent cases of typhoid fever still occur from drinking polluted water.

If we are to live with this piece of ordnance and ever have to use it again in the defense of our way of living, we must acquire a practical attitude, not only toward its efficiency or limitations as a bomb, but also to the possible effects and limitations of this "mysterious" radiation. We must recognize that the casualties caused by the blast and burns from this weapon will be many times greater than the deaths caused by radiation. We must also dispel the erroneous idea that the rescue work of the injured will be impossible due to residual radiation.

It is of the utmost importance that we recognize that the radiation hazards are *additional* hazards. They only add to the complexity and perhaps even the severity of the other hazards of total warfare. Therefore, we must not and cannot concentrate on this phase of atomic warfare to the detriment of other defensive preparations. Rather, we must know and understand the facts about ionizing radiations if we are to survive the other dangers.

U. S. Atomic Energy Commission
Washington 25, D. C.

SUMARIO

Factores Psicológicos en la Guerra Atómica

La publicidad concedida a los riesgos de la irradiación incidente a las explosiones de la bomba atómica ha hecho exagerar dichos peligros en comparación con los demás riesgos de la guerra. La llamada dosis de tolerancia de 0.2 ó 0.1 r al día no figura aquí, pues se trata de exposición aguda, y la dosis orgánica total recibida en dicha clase de exposición varía según el individuo.

En lo tocante a disciplina bélica y efectividad militar, el factor dominante no es el riesgo, sino la forma en que lo estima el soldado. Hay que comprender que existen muchos riesgos que superan a la radiación en su efecto sobre la vida y la salud. Es más, los efectos inmediatos de la explosión de la bomba, en forma de quemaduras y lesiones, ocasionaron un porcentaje mucho mayor de muertes en Hiroshima y Nagasaki que la radiación misma.

Entre los engaños por corregir figura la idea de que la irradiación residual de una bomba que estalle en el aire constituye un factor muy peligroso, contraindicando la entrada en una zona bombeada para el rescate de los heridos.

DISCUSSION

R. R. Newell, M.D. (San Francisco): I have been thinking about this matter very seriously for some months now. I've talked with Dr. Cooney at some length regarding it, and I've also argued with our Chairman, Dr. Stone, about it, and I still find that the problem is an exceedingly difficult one.

At Bikini, I took great pains to teach everybody engaged in the operation the limit that we set on exposure to radiation. We did succeed in teaching them that, and some of them have taken it for Gospel truth that one-tenth of a roentgen per day is the limit of radiation that can be borne. That, of course, is not strictly true, because two-tenths of a roentgen does not kill a person.

It has now become necessary to reduce this hazard to the same level of understanding that we have of the other hazards which are undergone in everyday life, but particularly in regard to the hazards which may be encountered in war. Unfortunately, there is a large moral and ethical overlay to all of these problems, and the morals and ethics of war are so far divorced from the morals and ethics of everyday life that it is rather hard to do psychological training during peacetime which would be adequate for control during time of war. I think that the important thing is that every one of us must keep his sense of proportion in regard to the various hazards and not put radiation danger so far above the other dangers that we find ourselves exposing civilians and troops to grave chance of death in the ordinary hazards of war in order to save them from no more than one thousandth as grave a chance of death by radiation, just because radiation scares us worse.

I will draw a parallel for that. In everyday life, we are acquainted with our inadequate, or shall I say our unbalanced, estimation of hazards. In popular opinion the hazards of poliomyelitis, for example, are overevaluated, as the number of people who die of that disease is very small compared to the number of people that die of many other diseases. Yet, the fright induced in the population in the presence of a polio epidemic sometimes approaches panic, and the amount of money which can be collected for its alleviation and control is out of all proportion to the number of injuries and deaths from this cause.

At the other extreme, we have the case of automobile accidents. The hazards of the highway approach the hazards of the most killing of our diseases, but these hazards are so underestimated that we are doing much less about them than we do with regard to diseases. There are many, many times as many dollars mobilized in an attempt to control cancer as there are in attempts to control traffic accidents, although traffic accidents are only just perceptibly below cancer as a cause of death.

What I am trying to get at is that these are perhaps rather small differentials in our evaluation of hazards. However, when we come to the radiation hazard, the differential (or shall I say, the discrepancy) in our estimation is overwhelmingly out of line at present, and we who have been teaching people that 0.1 r per day is the limit are responsible. Therefore, it seems that we must find some way of undoing this bad psychological situation which might ruin us completely in any war in which atomic weapons may be used in the future. That, I believe, is the difficult problem.

There is little quantitative difference between the radiation hazards and the other hazards of war, but the radiation hazards are insidious and not perceptible. Therefore, the men would be dependent upon the judgment and the ability of their officers to guide them. It would be perfectly possible for an officer to send troops into a region where they would all die of radiation in order to accomplish a mission which could be carried through in just a few hours. That would not be possible in the presence of any other war hazard, because the troops would evaluate the hazard as they went in, and when too many had been killed, the rest would turn around and run away. Up to the present time, therefore, military commanders have known how much hazard they could send troops into. It is possible for a commander, in order to save the lives of the large mass of a retreating regiment or army, to leave a unit behind to cover the retreat, knowing that the casualties of the covering unit will be very much increased. It would be possible, if the hazard were radiation, to leave men behind to protect the retreat even though the commander knew that the radiation to which those men would be exposed would kill them all. That would be possible; however, it would not be tolerable. I think that no military commander should make such a choice, because it would utterly destroy, for all time, the confidence of the men in the dependability of their command, because only the command has a way of finding out how high the radiation hazard is. The psychological responsibility, therefore, becomes perfectly enormous in the presence of a radiation hazard.

For this reason, it is necessary to get everybody in the country to understand what the radiation hazards amount to and what radiation level a person could really live through. We should certainly not have people believe that exposure to any least degree of radiation is going to kill them.

The decisions at the top level are made, we believe, on the basis of reason and logic. However, it is probably true that some of the decisions, and some of the appeals, are very largely made by field commanders on intuition, and they are probably also accepted by intuition on the part of the troops. Unless we have a sufficient understanding, an instinctive intuitive understanding, of the hazard involved, it will not be evaluated in its proper relation to other hazards. The consequence of that false evaluation would be that we would inevitably make all the wrong decisions. The hardest part of the problem at the present is that it is psychological.

Dr. Lawrence Knox (Pacific Palisades, Calif.): Since we are dealing with the psychological aspect of this problem, I may say that I find myself somewhat psychologically confused. A couple of years ago I heard Dr. Stafford Warren point out to a group of radiologists in the Los Angeles district their terrific responsibility for going out to the people of the country—the lay people—and acting as missionaries to let them know of the terrible things that we were facing with regard to atomic warfare. Now, it seems that we are being re-educated in another direction. Am I to understand that the hazard isn't as bad as Dr. Warren said?

In other words, we are not in a position where we can look at this international threat of use of the atomic bomb. We are not now in a position where we must fear this so greatly. Other things must be feared more than the total destruction that Dr. Warren warned us about. I understood that if 100 such bombs as were exploded were dropped, 90 per cent of the world's population would be threatened with aplastic anemia, if not dead from other intervening causes, in a period of two years after that hundredth bomb was dropped.

Is this, now, an education for death that we are being given? I would be interested to know whether the Colonel is speaking for himself or whether he is speaking under orders from Washington in order to calm down our reactions to a threatened war. I, for one, feel that psychologically there is something to be explained about this. I have been a missionary in spreading, to the lay people, the dangers that threatened them, and I still feel that the knowledge that I have of irradiation and its hazards shows that these cannot be overestimated.

It is true that hysteria has no place in the scientific mind. At the same time, I do not feel that I, as a scientist, can overlook the fact that psychologically, not only here but elsewhere, we are being prepared for what is considered to be a defense of our indefensible position. As the leading country in the world today, I think that we are threatening ourselves and the whole world with destruction.

Now, if all this can be minimized, if I can be convinced that I've been erroneous in what I've thought Dr. Warren said, if this thing is not a build-up for future destruction of 90 per cent of the civilization of the world, then I would like to know what the truth really is regarding this matter.

Robert S. Stone, M.D. (San Francisco): I believe that there are several points upon which we may be somewhat mixed up. I take it that the hazard of atomic warfare is not the thing about which Dr. Cooney is trying to get us quieted down, for he is dealing with one of the most destructive weapons that has ever been devised. I think that what he has been trying to get over to us is that, in spite of its destructiveness, the hazard of irradiation is relatively small in proportion to other hazards. We therefore should not worry about the radiation, since the other dangers are so much greater. In that, I would agree with him.

However, I think that Dr. Knox has brought up a very important point, namely, the fact brought out by Dr. Warren, that if we have a lot of radioactive material set forth in the air, by atom bombs, it will go around the world. I don't know whether it will take one bomb or a hundred or a thousand bombs, and I don't believe Dr. Warren knows either, for we don't know the present efficiency of the bomb. However, there is a hazard involved that has never existed before—and it is a hazard about which I think no psychological education will ever quiet us down—and that is that, once the bomb goes off, the radioactivity will continue to circulate around the world for a considerable time.

Now, if you have only one bomb, as at Nagasaki, there may be a dispute as to whether it will cause any increase in the level of radiation on the Pacific Coast, or on the Atlantic Coast. But if it's a matter of a hundred bombs or a thousand bombs (and when you get into a war, you're surely going to use as many as you possess or require to accomplish your purpose), we must think and make our military men think of something beyond the immediate present, because we are confronted by the certainty of continued radioactivity for some time to come. Moreover, as Dr. Muller will probably tell us, if we irradiate too many people, it isn't a question of what happens today, but it's a question of what happens to the generations that succeed this one, say 100, 200, or even 300 years from now.

In the case of war, we may take the immediate consequences as the important ones. During time of peace, however, we must emphasize both aspects of the matter, and I think that our military leaders have to take that into consideration.

I realize the point that Dr. Cooney is making, and that is that we have been trying to educate the troops and educate ourselves to the fact that this is a mysterious thing which we can't feel and can't see and can't touch and, that, as Dr. Newell pointed out, the troops going into an area don't know that the radiation is there. That, I believe, Dr. Cooney has answered by saying that there are many other hazards that we don't know about either, but which are there just the same. For instance, I understand that some of the most recent war gases can't be smelled, felt, or anything else, until the effects are apparent, so that there is no difference between these hazards in that respect.

I believe that the answer to our problem is education. I think that we should help the people to understand just what these things are and what we can find out about them. We should help them to understand that this is only one of the many hazards of war. We should therefore control ourselves, but we should realize that we're up against a new thing that is of great danger to the world, both from the immediate destruction and from the late effects as

a result of distribution of radioactivity around the world.

Colonel Cooney (*closing*): I just want to assure you that these are strictly my own ideas. I was not sent here by the War Department. Had the War Department attempted to send me here to talk about this thing, I believe that I would have refused to come. I am merely giving you my personal experiences, having been present around the detonation of five atomic bombs. I am not trying to underplay the effects of the atomic bomb; it is a horrible and frightening weapon of warfare. As Dr. Stone said, I was trying merely to evaluate the hazards. Now, of course, everyone is entitled to his own ideas, and the idea of two hundred bombs is Dr. Knox's idea. Thank God, we of this country can speak our minds. I've asked physicists at Los Alamos to calculate the number of bombs that would contaminate the world to a dangerous point, and they've given me a figure of one million, or from one to ten million, and I feel that if that number is correct, we certainly don't need to worry about the radiation effect on the world.

EDITORIAL

Wartime Radiation: The Calculated Risk

At Bikini some 70,000 persons were exposed to first-hand acquaintance with the atom bomb. This was priceless education for our American public, for these 70,000 are now dispersed throughout our 150,000,000 and act, we hope, as a leaven of understanding for which mere newspaper and radio essays could hardly substitute. In their attendance on the Bikini tests, these 70,000 were inevitably exposed to the wicked radioactivity generated by the explosion of an A bomb and left behind in such enormous quantity in its smoke.

This was a peacetime operation, even though done to gain data for possible wartime uses. It seemed axiomatic that it should be planned in such a way as to avoid hazard to those who carried it out, and that objectives should be limited to those fields where hazard could in fact be avoided. The President's instructions were therefore meticulously correct, namely: No person shall suffer any injury due to the peculiar nature of the atomic bomb.

In carrying out this order, a whole shipload of scientists and technicians built themselves into a school of radiation hygiene and a police force to implement its ideals of radiation safety. Part of the implementation consisted in education. Mostly this was not formal, but casual and by example. It resulted in nearly everybody's learning that radioactivity is bad, that it destroys the bone marrow, and that it injures the sex cells. The latter fact generated widespread and deep-seated emotion, for all men hate the mere notion of sexual sterility in themselves and ridicule it in others. The common confusion of sterility with impotence, which is even more detestable, added much to the emotional turbulence. Under this drive, a very large number of persons learned by heart that the tolerance limit is one-tenth of a roentgen per day.

By sticking conscientiously to this "official" limit, the directors of the operation were able to give the required assurance that the instructions in regard to safety had been carried out.

Now this so-called "tolerance dose" is not proved to be completely tolerable in the sense of producing no deleterious effects whatever. More recently one sees a tendency to call it rather the "permissible daily dose." From animal experiments one is led to think that the tiniest amounts of radiation can produce injurious changes in heredity, even cosmic rays. However, one-tenth of a roentgen a day can be borne for a very long time, day after day, before any injury produced accumulates to the level where one can detect that there is any real damage at all. That "permissible dose" was arrived at by measuring the radiation fields in radium institutes where people had been regularly employed for years at a time without apparent bad effects. It was generally agreed to by practising radiologists, who thought that one erythema dose accumulated over an industrial lifetime would be a conservative limit. Twenty years of 250 working days a year is 5,000 days, and 500 r in 5,000 days is 0.1 r per day.

Recent work with small mammals has shown that half a roentgen a day does accumulate to produce demonstrable injury to the blood-forming organs in a couple of years. There is some slight suspicion of injury observed in persons exposed to one-tenth that much, but not enough to be sure of. The National Committee on Radiation Safety has now reduced the "permissible daily dose" to 0.3 r per week (National Bureau of Standards Handbook 41).

As stated above, this limit is applicable to peacetime activities, to situations where the hazards of civilized life are such as we are all acquainted with and adapted to. And it is based on a proper determination not to increase those hazards willfully or carelessly.

But we are in a world where emergencies seem to come ever more frequently, particularly political emergencies. Specifically, we are continually faced by the chance of war. Without permitting anyone to make profit, financial or political, out of this unhappy chance, it yet behooves us to prepare ourselves as well as we can, so that, should it come, we may yet win the war. I am one of those who believe that war has become so bad that a nation, even though it win the war, must inevitably lose more than it gains. But surely if war be not in fact successfully avoided, it is better to win it than lose it.

Besides the material and personnel preparedness, which we are in fact prosecuting within our material and political limitations, there is also needed a psychological preparation. When wars were fought solely by armed forces on limited battle fields, this psychological preparation was covered largely by training and indoctrination of the fighting men. Now, when it is clear that the next war will be fought largely by aerial attack on the home industrial potential of the belligerents, one appreciates the need for psychological preparedness also among the non-combatant populace.

Nobody yet knows the effect of an atomic bomb on an industrial city *when the populace knows about radioactivity.* Panic was less than the militarists expected in cities subject to TNT and incendiary bombing. But what will be the panic where people know that death or, at the least, sterility emanates from everything that the smoke of the bomb has touched—an emanation that cannot be perceived by any of the senses, but only imagined—and how vividly!—or measured by an expert with an almost occult instrument.

Here we will have radiation hazards in quite a different setting from peaceful civilian life, different even from Bikini or Eniwetok. Surrounded by the immediate and evident hazards of military attack in a flaming city, the hazard of 0.1 r per day will seem like nothing. But it will seem like nothing only to those who know that such irradiations take years to accumulate to a damaging level.

How many "men in the street" know that in attacking such diseases as cancer and leukemia, doctors have been accustomed to give thousands of roentgens locally, and series totalling a hundred or more roentgens over the whole body? How many know that it takes several hundred roentgens in one dose to kill a small mammal (mouse or rat)? Who has sampled the opinion of x-ray specialists as to whether a man would survive 100 r over his whole body? (I am sure he would.) People must learn the quantitative facts of radiation hazard, unless they are taught to temper the peacetime permit of 0.3 r per week with knowledge of man's ability to live through 100 r (once). Unless they do learn this, they are likely to do all the wrong things in fear of the "deadly" radiation in regions where it is in fact not deadly, and so lose their lives needlessly as a result of panic.

For fighting men these lessons are even more acutely important, for there may arise occasions when voluntary exposure to radiation is necessary in order to gain military objectives. Indoctrinated as he is today, what soldier should be asked to brave 1,000 r a day—10,000 times the danger limit? That's fantastic, unless one have the Kamikazi complex. Yet such a military mission is in fact quite thinkable to a practised radiologist, if the duration of the exposure is limited to half an hour.

In war, therefore, where risks are part of the very fabric of life, radiation hazards should be measured in different quanta from what we use in peace. The roentgens should be parcelled out in sizes comparable to the other risks of the campaign. In a fighting division, after a year's campaign-

ing, one will find hardly any of the original men remaining, replacements on account of death, wounds, and illness (including battle fatigue) having run through almost the entire roster. In such a situation it becomes ridiculous to talk about 0.1 r per day and the accumulation of bone-marrow injury after ten or twenty years of exposure.

Now, having been at such pains to teach one "safe level," how shall we go about teaching a level 1,000 or 10,000 times higher as a "calculated risk?"

R. R. NEWELL, M.D.

ANNOUNCEMENTS AND BOOK REVIEWS

AMERICAN BOARD OF RADIOLOGY

At the recent meeting of the American Board of Radiology in Atlantic City Dr. Ira H. Lockwood was elected President, Dr. Douglas Quick Vice-President, and Dr. B. R. Kirklin Secretary. Dr. Lockwood is a member of the Board of Directors of the Radiological Society of North America and is serving his second term on the American Board of Radiology.

ALABAMA RADIOLOGICAL SOCIETY

At the annual meeting of the Alabama Radiological Society recently held in Montgomery, Dr. Carl Kesmodel of Birmingham was elected President; Dr. E. B. Teague of Birmingham, Vice-President, and Dr. W. D. Anderson, 420 10th St., Tuscaloosa, Secretary-Treasurer.

The next annual meeting will be held in April 1950 at the time of the meeting of the Alabama State Medical Association.

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY

The annual mid-summer meeting of the Rocky Mountain Radiological Society will be held in Denver, Colo., at the Shirley-Savoy Hotel, Thursday to Saturday, Aug. 18–20. A special feature of the meeting is a Symposium and Round-Table Luncheon Discussion on "Ethics and Economics in Radiological Practice," with Dr. James P. Kerby presiding. Symposia are also scheduled on the lesser circulation and chest diseases and on radioactive isotopes.

At a joint meeting with the Medical Society of the City and County of Denver, on Thursday evening, the guest speakers will be Dr. Paul C. Swenson of Philadelphia, whose subject will be "Problems in the Roentgen Examination of the Gastro-Intestinal Tract," and Dr. Charles L. Martin of Dallas, Tex., who will discuss "The Treatment of Intra-Oral Cancer."

An informal banquet will be held Friday evening and a picnic at Pine Gables Ranch on Saturday afternoon.

Further details may be obtained from the Secretary of the Society, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr.

THIRD INTER-AMERICAN CONGRESS OF RADIOLOGY

Attention is again called to the Third Inter-American Congress of Radiology to be held in Santiago and Viña del Mar, Chile, Nov. 11–17, 1949. The official topics for discussion appear in RADIOLOGY for April 1949 and need not be repeated here. Details as to the presentation of papers and preparation of exhibits may be obtained from the undersigned.

About two hundred and fifty radiologists were enrolled in the Second Inter-American Congress of Radiology, which took place in Havana, Cuba, in November 1946, and it is hoped that an equally good attendance may be counted upon for the Santiago meeting. Those who are pressed for time may make the trip by air; those with more time will find it enjoyable to travel by boat, part or all of the way. One may go *via* the Atlantic coast, visiting Havana, San Juan, and the principal ports in Brazil, Uruguay, and the Argentine, then across the Andes by train or by plane to Santiago. The return trip may be made *via* the Pacific coast, by steamer through the Panama Canal, or by plane. If the traveler has time, visits may be made in Guatemala, Yucatan, and perhaps in the capital city of Mexico. Various modifications of these trips are available, to cover as much as a couple of months or as little as twenty-one days. Southern Chile is noted for its tourist attractions.

Travel arrangements may be made individually or by any convenient travel agent. The McGuire Travel Agency, 333 N. Michigan Ave., Chicago 1, Ill., has been serving the committee very acceptably. The travel agency should make all room reservations, but no matter how one travels, it is requested that the undersigned, as regional secretary, be informed.

Adherents to the Congress should send in a check for twenty dollars, which will entitle the sender to the Proceedings of the Congress whether or not he attends the meeting. One may be a member without attending.

Passports will have to be arranged and the necessary visas obtained. The travel agency will be of much assistance in this regard. Inquiries may also be addressed to the Regional Secretary.

JAMES T. CASE, M.D.
Regional Secretary
55 East Washington St.,
Chicago 2, Ill.

NEW PORTABLE X-RAY STEREOSCOPE

A new portable x-ray stereoscope, weighing only $6\frac{1}{2}$ pounds, has been designed by the Engineering Development Division of the Armed Services Medical Procurement Agency at its Fort Totten, N. Y., laboratories. This is constructed principally of aluminum and is intended for use in mobile field hospitals as a companion item to a light-weight film cassette changer recently developed by the same agency. It employs two single illuminators which are standard items of medical issue for the Army,

Navy, and Air Force. The illuminators can be used for reading flat and stereoscopic films.

The optical section, containing mirrors and adjusting mechanism, is sealed against moisture and dust to insure its efficiency under field conditions. Masking shutters are provided for the viewing of small films and the optical adjustment is easily accomplished by a single control knob.

In Memoriam

DR. LUDWIG HALBERSTAEDTER

Dr. Ludwig Halberstaedter, Professor of Radiology and Chief of the Cancer Laboratories of the Hebrew University in Jerusalem since 1935, died in New York City, on April 21, 1949, at the age of seventy-two. Dr. Halberstaedter was formerly Chief of the Department of Radiotherapy at the University of Berlin. He is credited with being the first to recognize the specific action of x-rays on the ovaries, thus furnishing the basis for much of present-day gynecological radiotherapy. He was also among the pioneers in high-voltage therapy and developed one of the early million-volt units.

Dr. Halberstaedter was a member of the American Society for Experimental Biology and Medicine, and of the British Institute of Radiology.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

MALIGNANT DISEASE AND ITS TREATMENT BY RADIUM. By SIR STANFORD CADE, K.B.E., C.B., F.R.C.S., M.R.C.P., Surgeon, Westminster Hospital, Mount Vernon Hospital and Radium Institute; Lecturer in Surgery, Westminster Hospital Medical School and formerly Examiner in Surgery, University of London; Member of the Court of Examiners, late Hunterian Professor and Arris and Gale Lecturer, Royal College of Surgeons of England; Member of the National Radium Commission and Trust; Consultant in Surgery to the Royal Air Force. With a foreword by SIR ERNEST ROCK CARLING, F.R.C.P., F.R.C.S., F.F.R., Consulting Surgeon and Vice-President, Westminster Hospital. Second Edition, Volume II. A volume of 430 pages, with 205 illustrations and 66 tables. Published by Williams & Wilkins Co., Baltimore, 1949. Price $12.50.

HOW TO BECOME A DOCTOR. A COMPLETE GUIDE TO THE STUDY OF MEDICINE, DENTISTRY, PHARMACY, VETERINARIAN MEDICINE, OCCUPATIONAL THERAPY, CHIROPODY AND FOOT SURGERY, OPTOMETRY, HOSPITAL ADMINISTRATION, MEDICAL ILLUSTRATION, AND THE SCIENCES. By GEORGE R. MOON, A.B., M.A., Examiner and Recorder, University of Illinois Colleges of Medicine, Dentistry, and Pharmacy. A volume of 132 pages. Published by The Blakiston Co., Philadelphia, 1949. Price $2.00.

CLINICAL RADIATION THERAPY. By IRA I. KAPLAN, M.D., F.A.C.R., Clinical Professor of Radiology, New York University Medical College; Attending Radiation Therapist, Beth-David Hospital, New York; Director, Radiation Therapy Department, Bellevue Hospital, New York. A volume of 844 pages, with 614 illustrations. Published by Paul B. Hoeber, Inc., New York. 2d ed., 1949. Price $15.00.

BROOKHAVEN CONFERENCE REPORT. BIOLOGICAL APPLICATIONS OF NUCLEAR PHYSICS. JULY 12–27, 1948. A volume of 154 pages, with 67 illustrations and 32 tables. Published by Brookhaven National Laboratories, Associated Universities, Inc., Upton, L. I., N. Y. Price $1.50. Publication No. BNL-C-4. Requests or purchase orders should be directed to the Information and Publications Division, and checks and money orders should be made payable to Brookhaven National Laboratory.

AN INQUIRY INTO THE EXTENT TO WHICH CANCER PATIENTS IN GREAT BRITAIN RECEIVE RADIOTHERAPY. Report based on information supplied to the National Radium Commission by National and Regional Radium Centres and London Teaching Hospitals. By MARGARET TOD, F.R.C.S. (Ed.), F.F.R., Acting Secretary Radium Commission, 1947–48. A booklet of 48 pages. Published by John Sherratt and Son, Altringham. Copies may be obtained, 3*s.* 6*d.* postpaid, from the Holt Radium Institute, Withington, Manchester, 20, England.

EXPLORATION RADIOLOGIQUE DE L'APPAREIL URINAIRE INFÉRIEUR (VESSIE-URÈTRE-PROSTATE). By BERNARD FEY, FERNAND STOBBAERTS, PIERRE TRUCHOT, AND GEORGES WOLFROMM, with the collaboration of LÉONCE SABADINI, FELIX DEGAND, JACQUES DESCLAUX, GEORGES DULAC, MARCEL DUTRIEUX, MAURICE GILSON, ALEXANDRE GYÖRFI, JEAN ROUSSEAU, and ALBERT SORIN. A volume of 292 pages, with 293 illustrations. Published by Masson et Cie, Paris, 1949.

Book Reviews

CARDIAC CATHETERIZATION IN CONGENITAL HEART DISEASE. A CLINICAL AND PHYSIOLOGICAL STUDY IN INFANTS AND CHILDREN. By ANDRÉ COURNAND, M.D., Associate Professor, Department of Medicine, College of Physicians and

Surgeons, Columbia University, JANET S. BALDWIN, M.D., Assistant Professor, Department of Pediatrics, New York University College of Medicine, and AARON HIMMELSTEIN, M.D., Instructor, Department of Surgery, College of Physicians and Surgeons, Columbia University. A volume of 108 pages, with numerous illustrations. Published by The Commonwealth Fund, New York, 1949. Price $4.00.

The literature of cardiac catheterization is still meager enough that a new contribution calls for special notice. Especially is this so when it combines the physiologic, clinical, and roentgenologic aspects of this recently developed technic. Dr. André Cournand of Columbia University, with Dr. Janet Baldwin and Dr. Aaron Himmelstein, in the monograph "Cardiac Catheterization in Congenital Heart Disease," has made such a study in a varied group of congenital defects. Much of the work was done on young children and infants.

The monograph is divided into two parts. In Part I are described the physiological methods employed in the studies upon which the work is based. One chapter is given over to the equipment, the technic, and the complications that may be expected. The second chapter describes the roentgen findings during catheterization, with appropriate illustrations depicting the catheter in the various chambers and under various conditions. Chapter III shows the characteristic patterns of the blood pressure tracings, and Chapter IV the formulae used for calculation of the systemic and pulmonary blood flow and of blood shunts.

Part II is made up of records of 17 cases illustrating various types of cardiac malformations. The data for each are presented in a simple schematic form, including brief clinical notes, a short history, physical findings, with special reference to the heart, electrocardiographic tracings, roentgenologic studies, including esophagrams, a diagrammatic representation of calculations of blood flow and shunts, the follow-up history including operative or autopsy findings when available, and general comments.

Those interested in the study of congenital heart lesions and their treatment will find this monograph most informative. The plan of the work and the excellent execution from a technical point of view enhance its usefulness.

CANCER OF THE ESOPHAGUS AND GASTRIC CARDIA. Edited by GEORGE T. PACK, B.S., M.D., New York, N. Y., Clinical Professor of Surgery, New York Medical College; Attending Surgeon, the Memorial Hospital for Cancer and Allied Diseases. A volume of 192 pages, with numerous illustrations and tables. Published by C. V. Mosby Co., St. Louis, Mo., 1949. Price $5.00.

This monograph is a reprinting of a symposium which appeared in the June 1948 issue of *Surgery*. There are eleven articles in addition to the introduction by the editor. In the introduction, Pack rather pungently decries the fact that the endoscopic specialists have over-ritualized esophagoscopy and bronchoscopy so that these diagnostic aids are not available to individuals in many communities well supplied with qualified non-specialists who could perform them. He describes Nielsen's rotary radiation treatment for carcinoma of the esophagus, and mentions the Scandinavian radiologist's belief that thoracic surgeons have less to offer this group of patients. Most of the other articles are on the technic of resection of the various portions of the esophagus from the cervical region to the gastric cardia. The authors of these articles are from various centers in New York, Boston, Rochester, (Minn.), Chicago, New Orleans, and Santiago, Chile. After scanning these writings, one has a good idea of what is being attempted and accomplished in present-day surgery of the esophagus.

INDUSTRIAL FLUOROSIS. A STUDY OF THE HAZARD TO MAN AND ANIMALS NEAR FORT WILLIAM, SCOTLAND. A REPORT TO THE FLUOROSIS COMMITTEE, by JOHN N. AGATE, *et al.* Medical Research Council Memorandum No. 22. Published by His Majesty's Stationery Office, London, 1949. Price 4*s.* 0*d.* net. Available at the British Library of Information, 50 Rockefeller Plaza, New York, N. Y.

This is the report of a comprehensive survey of the aluminum factories at Fort William, Scotland, and their vicinity. The discovery that animals in the neighborhood were apparently suffering from the effects of an excessive intake of fluorine, the recognition that large quantities of fluorine compounds escaped into the atmosphere from the aluminum factory, and the reporting of some dental changes among school children in the area led to this study.

The investigators report chronic endemic dental fluorosis in both sheep and cattle reared on contaminated pastures in the neighborhood of the aluminum factory. This was sufficiently widespread to constitute a serious economic hazard. Clinical and pathological examinations of some of these animals revealed mottling of the enamel and deformity of the incisor teeth. The cheek teeth showed excessive wear, forming long sharp points which pressed into the gum of the opposing jaw. The interlocking of these worn teeth prevented the animal from chewing its food effectively and resulted in severe malnutrition in some instances. Chemical analysis of teeth and bone showed an excessive fluorine content. Osteodystrophia was also found in cattle grazing near the factory.

Volunteers from among the workers in the aluminum factory and from adults and school children living in the neighborhood were examined. A striking feature of these examinations was the absence of disabling symptoms, though a proportion of furnace-room workers complained of cough

and various digestive disturbances. The amount of fluorine excreted in the urine was highest in those with the greatest exposure; *i.e.*, furnace-room workers in the least modern furnace rooms.

Roentgen examination of 437 volunteers showed some degree of abnormality in 56. A few showed changes consistent with skeletal fluorosis. Among the older furnace-room men examined, the incidence of skeletal abnormality was found to increase with increasing length of exposure to factory fumes. Thus far, none of these affected workers had suffered clinical disability.

Clinical examination of a small number of residents in the neighborhood of the factory showed no sign of injury to health.

In conclusion, a warning is issued that the roentgen demonstration of bone changes in a few workers should, despite lack of clinical disability, call for determined efforts to reduce the amount of fluorine to which the workers are exposed. Furthermore, it is held that new residential developments in the vicinity of the factories should be located in such a way that, so far as possible, residents are kept out of the zone known to be most liable to contamination. It follows that everything practicable should be done to reduce the amount of fluorine discharged from the factories.

CANCER. TOME II. RADIATIONS—VIRUS—ENVIRONMENT. By DOCTEUR J. MAISIN, Professeur a l'Université de Louvain, Directeur de l'Institut du Cancer à Louvain. A volume of 308 pages. Published by Casterman, Tournai-Paris, 1949. Price 120 francs.

The first volume of Professor Maisin's survey of experimental and theoretical publications on the subject of cancer was reviewed in RADIOLOGY in September 1948. The subject of the second volume is the relation of radiation to cancer and the possible etiologic role which parasites, microbes, and viruses may play, plus the adjuvant action of local irritants, food, and enzymes. These are fields in which very active research is being carried on in many directions, as, for example, the question of the virus origin of breast cancer, illustrated in the studies of Bittner and Passey on mice.

The work on the production of sarcomata of the liver due to a tapeworm, which occupied Curtis and Dunning of the Crocker Cancer Institute for many years, is well reviewed. An interesting end-result of this was that, out of the thousands of sarcomata which followed infestation with the parasite, only one carcinoma developed, and only a few osteogenic sarcomata. On the other hand, feeding experiments with butter-yellow produce cancer of the liver and not sarcomata, as the Japanese have shown. Not much headway has been made of late with the virus chicken sarcoma with which Rous's name will always be associated, and it is finally acknowledged that Fibiger's carcinoma of the stomach is due not to a parasite, but to dietary factors.

The work of Greene, using the anterior chamber of the eye of guinea-pigs as a test tube for the growth of human cancer, is discussed. Shabad's work in showing that carcinogenic substances can be extracted from the organs of normal human beings is also referred to, but the suggestion that such substances may be derived from food is too recent to be included. The work of Needham on the chemical factors in embryology is mentioned, and finally that most important discovery of W. R. Earle, who showed that, by cultivating fibroblasts in an artificial medium for a long period, races of cancer cells will occasionally appear without any external influence. Someone will immediately say that this is due to the cosmic rays. These rays have recently been popularized to an extent that they are being held responsible for almost everything that goes on, but it might be well to recall that their energy is so small that, as some ingenious writer has stated, one might as well attempt to get a sunburn by exposing himself to starlight on a clear night. This statement may immediately be challenged by saying that a single high-voltage radiation might hit the nucleus of a cell and change it into a cancer cell, but it has been shown that mice kept at a high altitude in the Alps developed no more cancers than those of the same strain at sea level, and the Swiss mountaineers who, according to the ray theory, should all have died of cancer, are well known to be one of the sturdiest races in Europe.

Enough has been said to show that those with a knowledge of easy French will find this work of Maisin's an interesting and profitable method of informing themselves of the latest investigations in the field of cancer.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Hugh F. Hare, M.D., 605 Commonwealth Ave., Boston 15, Mass.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Harold Dabney Kerr, M.D., Iowa City, Iowa.

AMERICAN COLLEGE OF RADIOLOGY. *Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6, Ill.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. D. Anderson, M.D., 420 10th St., Tuscaloosa.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Sydney F. Thomas, M.D., Palo Alto Clinic, Palo Alto.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, 434 30th St., Oakland 9. Meets monthly first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, Wybren Hiemstra, 1414 S. Hope St. Meets monthly, second Wednesday, County Society Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, Charles E. Grayson, M.D., Medico-Dental Bldg., Sacramento 14. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Wm. F. Reynolds, M.D., University Hospital, San Francisco 22. Meets third Thursday at 7:45, January to June at Stanford University Hospital, July to December at San Francisco Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Mark S. Donovan, M.D., 306 Majestic Bldg., Denver 2. Meets third Friday of each month, at the Colorado School of Medicine and Hospitals.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Fred Zaff, M.D., 135 Whitney Ave., New Haven. Meetings bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Ellwood W. Godfrey, M.D., 1676 Boulevard, W. Hartford. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, Alfred A. J. Den, M.D., 1801 K St., N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Auditorium.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John J. McGuire, M.D., 1117 N. Palafox, Pensacola. Meets in April and in November.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Wm. W. Bryan, M.D., 490 Peachtree St., N. E. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert Drane, M.D., De Renne Apartments, Savannah. Meets in November and at the annual meeting of State Medical Association.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, John H. Gilmore, M. D., 720 N. Michigan Ave., Chicago 11. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly as announced.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Harold L. Shinall, M.D., St. Joseph's Hospital, Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, William M. Loehr, M.D., 712 Hume-Mansur Bldg., Indianapolis 4. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Anthony F. Rossitto, M.D., Wichita Hospital, Wichita. Meets annually with State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Everett L. Pirkey, M.D., 323 East Chestnut St., Louisville 2.

LOUISVILLE RADIOLOGICAL SOCIETY, *Secretary-Treasurer*, Everett L. Pirkey, Louisville General Hospital, Louisville 2. Meets second Friday of each month at Louisville General Hospital.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary*, J. Howard Franz, M.D., 1127 St. Paul St., Baltimore 2.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary-Treasurer*, George Belanger, M.D., Harper Hospital, Detroit 1. Meetings first Thursday, October to May, at Wayne County Medical Society club rooms.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS. *Secretary-Treasurer*, R. B. MacDuff, M.D., 220 Genesee Bank Building, Flint 3.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, C. N. Borman, M.D., 802 Medical Arts Bldg., Minneapolis 2. Meets in Spring and Fall.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Wm. M. Kitchen, M.D., 1010 Rialto Building, Kansas City 6, Mo. Meetings last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Charles J. Nolan, M.D., 737 University Club Bldg. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ralph C. Moore, M.D., Nebraska Methodist Hospital, Omaha 3. Meets third Wednesday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, George Levene, M.D., Massachusetts Memorial Hospitals, Boston. Meets monthly on third Friday at Boston Medical Library.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary-Treasurer*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meetings quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Raphael Pomeranz, M.D., 31 Lincoln Park, Newark 2. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M.D., East Rockaway.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, J. Daversa, M.D., 603 Fourth Ave., Brooklyn. Meets fourth Tuesday of each month, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*. Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary-Treasurer*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 10. Meetings in January, May, and October.

LONG ISLAND RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening, October to May, at 8:45 P.M., in Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Wm. Snow, M.D., 941 Park Ave., New York 28.

QUEENS ROENTGEN RAY SOCIETY. *Secretary*, Jacob E. Goldstein, M.D., 88-29 163rd St., Jamaica 3. Meets fourth Monday of each month.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, Ralph E. Alexander, M.D., 101 Medical Arts Bldg., Rochester 7. Meets at Strong Memorial Hospital, third Monday, September through May.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary-Treasurer*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Charles Heilman, M.D., 1338 Second St., N., Fargo.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Carroll Dundon, M.D., 2065 Adelbert Road, Cleveland 6. Next meeting at annual meeting of the State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Paul D. Meyer, M.D., Grant Hospital, Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Seneca Hotel, Columbus.

CINCINNATI RADIOLOGICAL SOCIETY. *Secretary*, Eugene L. Saenger, M.D., 735 Doctors Bldg., Cincinnati 2. Meets last Monday, September to May.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Hannan, M.D., Cleveland Clinic, Cleveland 6. Meetings at 6:30 P.M. on fourth Monday, October to April, inclusive.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. E. Brown, M.D., 21st and Xanthus, Tulsa 4. Meets in October, January, and May.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Boyd Isenhart, M.D., 214 Medical-Dental Bldg., Portland 5. Meets monthly, on the second Wednesday, at 8:00 P.M., in the library of the University of Oregon Medical School.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, Arthur Finkelstein, M.D., Graduate Hospital, Philadelphia. Meets first Thursday of each month at 8:00 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22d St.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, R. P. Meader, M.D., 4002 Jenkins Arcade, Pittsburgh 22. Meets second Wednesday of each month at 6:30 P.M., October to June.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., Lincoln Clinic, Lincoln, Nebr. Next meeting in Denver, Colo., Aug. 18–20, 1949.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer* Marianne Wallis, M.D., 1200 E. Fifth Ave., Mitchell. Meets during Annual Session of State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. Meetings second Tuesday of each month at University Center.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frére, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meetings on third Monday of each month in Dallas in the odd months and in Fort Worth in the even months.

HOUSTON X-RAY CLUB. *Secretary*, Curtis H. Burge, M.D., 3020 San Jacinto, Houston 4. Meetings fourth Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting Feb. 3–4, 1950, in Dallas.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk 7.

Wasnington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Homer V. Hartzell, M.D., 310 Stimson Bldg., Seattle 1. Meetings fourth Monday, October through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Theodore J. Pfeffer, M.D., 839 N. Marshall St., Milwaukee 2. Meets monthly on second Monday at the University Club.

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY. *Secretary*, S. R. Beatty, M.D., 185 Hazel St., Oshkosh. Two-day meeting in May; one-day with State Medical Society, September.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursdays 4 P.M., September to May, Service Memorial Institute, Madison 6.

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Jesús Rivera Otero, M.D., Box 3542, Santurce, Puerto Rico.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS *Honorary Secretary-Treasurer*, E. M. Crawford, M.D. Associate Honorary Secretary-Treasurer, Jean Bouchard, M.D. *Central Office*, 1535 Sherbrooke St., West, Montreal 26, Quebec. Meetings in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origéne Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPIA *General Secretary*, Dr. Dionisio Pérez Cosío, Marsella 11, México, D. F. Meetings first Monday of each month.

ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

The Chest

The Digestive System

The Diaphragm

The Musculoskeletal System

Gynecology and Obstetrics

The Genito-Urinary System

The Spinal Cord

The Blood Vessels

Technic

RADIOTHERAPY

RADIOACTIVE ISOTOPES

EFFECTS OF RADIATION

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Spontaneous Rupture of the Cerebral Ventricles. Arne Torkildsen. J. Neurosurg. **5:** 327–339, July 1948.

In cases of stenosis of the sylvian aqueduct or occlusion of the third ventricle, the cerebrospinal fluid that is produced within the cavities of the lateral ventricles is prevented from arriving at the place of resorption, that is, the subarachnoid space. A condition thus arises which is characterized by a pressure that is higher above the place of obstruction than below. With occlusion of the foramina of Monro, a relative hypertension exists within the lateral ventricles, and with occlusion of the sylvian aqueduct, relative hypertension exists within the lateral ventricles and the third ventricle as compared with the pressure in the subarachnoid space. If, under these conditions, the difference between the pressure inside and outside the ventricular system is great enough, a rupture of the ventricular wall may take place. The result of such a rupture depends upon its location and its relationship to the membranes covering the central system.

Until recently ruptures of the cerebral ventricles have been accidental findings at autopsy. The time has now come for the clinical recognition of this condition. Pneumographic air studies should bring the diagnosis from the postmortem room to the x-ray department.

Five cases of spontaneous rupture of the cerebral ventricular system are reported. In 4 cases the rupture resulted in the formation of a cyst occupying the interpeduncular space, extending below the tentorium and covering the quadrigeminal plate. In 1 of this group an aperture was seen in the posterior portion of the lateral ventricle near the mid-line. This seems to be the most common location, as far as one can judge by the scanty literature. In 2 cases a rupture of the posterior wall of the third ventricle had taken place. In 1 case there was no postmortem examination. The fifth case differed from the others in that the rupture did not create a cyst below the tentorium. After the spontaneous rupture the cerebrospinal fluid filled the supratentorial subdural space on the left side, resulting in cerebral compression.

Stenosis of the sylvian aqueduct is a common cause leading to spontaneous ventricular rupture, but slowly growing tumors also frequently come into consideration. The accompanying intracranial hypertension should be treated by ventriculocisternostomy.

The ventriculograms in the 5 cases are reproduced.

Nine roentgenograms; 5 photographs.

Pneumocephalus Secondary to a Penetrating Wound of the Brain. Sidney W. Gross. J. Neurosurg. **5:** 405–406, July 1948.

A case of pneumocephalus resulting from a penetrating wound of the brain is reported. Roentgenograms of the skull showed a defect in the right frontal area with a cluster of bone chips in the right frontal lobe. A metallic foreign body was present in the midline in the region of the foramen of Monro. Both lateral ventricles were filled with air. Debridement and a plastic repair of the defect in the dura were followed by a satisfactory result.

Two roentgenograms.

Vascular Tumors of the Brain and Spinal Cord and Their Treatment. Mason Trupp and Ernest Sachs. J. Neurosurg. **5:** 354–371, July 1948.

Blood vessel tumors of the nervous system have been divided by Cushing and Bailey into four groups: (1) telangiectases, (2) angioma venosum, (3) angioma arteriale, and (4) hemangioblastoma. That the first three types are not true neoplasms is well recognized by pathologists; it is with these tumors that the authors are concerned. They report 28 cases. Of these, 7 occurred in the spinal cord and the other 21 occurred in the cerebral or cerebellar cortex. At times it was impossible to determine to which group a case belonged. In early cases, the symptoms are indistinguishable and in the well developed case it is often quite impossible to differentiate between an angioma venosum and an angioma arteriale.

The diagnosis of these conditions prior to operation is difficult; in fact, in most cases it may be little more than a suspicion. Occasionally it may be made from the roentgenogram, as in a case of arteriovenous angioma of the cortex here reported. In this case, many of the larger vessels of the angioma were seen to be calcified, but at operation the picture that presented was very different, for, in addition to the larger vessels seen in the roentgenogram, there was a mass of capillary vessels. In the spinal cases, there is usually nothing distinctive, though, when paraplegia suddenly occurs in a patient with a large skin telangiectasis, with a level corresponding to the site of the skin lesion, the diagnosis is obvious. In the cranial cases, the history of prolonged jacksonian convulsions without pressure symptoms, and without a history of trauma, should make one suspect an angioma. If, in addition, there are lesions in the skin, this becomes more likely. If there is a vascular abnormality of the retina, an intracranial blood vessel lesion is probable.

The spinal cases in this series presented the picture of a focal spinal lesion which might be produced by any tumor. The cranial cases, on the other hand, had local signs, but the one sign most striking was the absence of choked disk.

Since 1929, the authors have been using their own method of electrocoagulation on these tumors whenever possible. In the present series it was employed 19 times and was efficacious in 15 cases. In the series of 28 cases, there were 4 operative deaths. In some instances the operation was followed by deep roentgen therapy. While this is routine procedure with hemangioblastoma, it is not clear how much effect irradiation has on the telangiectatic-like lesions or angiomas containing huge vessels. It is thought that in one case an excessive amount of irradiation may have been a factor in the patient's death, eleven years after she was first seen.

One roentgenogram; 8 drawings.

Arteriovenous Aneurysms of the Brain. Their Diagnosis and Treatment. Herbert Olivecrona and Johannes Riives. Arch. Neurol. & Psychiat. **59:** 567–602, May 1948.

Although cerebral arteriovenous aneurysm is a fairly uncommon lesion, the authors are able to present their experience in 60 cases. Most of the aneurysms came

from branches of the internal carotid artery but a few were supplied by the external carotid, and two by the vertebral artery. The most common symptoms were epilepsy, subarachnoid hemorrhage, and hemiplegia. The symptoms at first occurred at long intervals, with gradually increasing frequency and intensity. Mental deterioration was frequently observed in long-standing cases. A bruit was heard over the skull in about 25 per cent of the series.

The roentgen findings in the skull included increased vascularity in 20 per cent of the cases. This was a constant feature when the blood supply of the aneurysm came from the external carotid. Occasionally there was increase in diameter of the foramen spinosum and an enlarged channel for the middle meningeal artery. When the vascular supply was mainly from the internal carotid artery, no changes were noted in the bony structure of the skull. Calcification was not common; it was confined to the blood vessel walls and old clots. Encephalograms showed cerebral atrophy most frequently and occasionally slight dislocation of the ventricular system.

Cerebral arteriograms will demonstrate the aneurysm. The authors used perabrodil, injected percutaneously. Both lateral and frontal exposures were made. One case was recorded in which the aneurysm was outlined by contrast medium injected into the contralateral carotid artery. Often arteriograms of both external and internal carotid arteries were made and, rarely, of the vertebral artery.

Treatment, when possible, should be operative removal of the aneurysm. Roentgen therapy is not highly considered. The operative mortality was about 11 per cent. One third of the patients were greatly benefited.

Twenty roentgenograms; 6 photographs; 2 tables.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Cerebral Arteriography in Subarachnoid Hemorrhage. I. S. Wechsler and S. W. Gross. J. A. M. A. **136:** 517–521, Feb. 21, 1948.

The authors believe that much of the uncertainty as to diagnosis and prognosis in spontaneous subarachnoid hemorrhage can be dispelled by cerebral arteriography. In a number of cases it provides definite indications for successful treatment and in some may lead to prevention of recurrent bleeding.

Diodrast is the contrast material used by the authors. On the basis of their own experience, both in the acute and subacute stages of subarachnoid hemorrhage, they state with assurance that the injection for visualization of the arteries is a safe procedure.

The statement frequently made that spontaneous subarachnoid hemorrhage is generally the result of rupture of a cerebral aneurysm, especially of the circle of Willis, is not borne out. Of the rather small series of 10 cases reported here, 6 were the result of vascular malformations demonstrated by arteriography, and only 4 of aneurysms. In 3 of the latter the aneurysms were near the bifurcation of the carotid, and in the fourth the aneurysm was presumed to have burrowed into the temporal lobe, where it ruptured and caused a large intracerebral hemorrhage.

Three of the patients in this series who had several recurrent episodes of subarachnoid bleeding were found to have vascular malformations. Three others with vascular malformations were observed during their initial attack or shortly thereafter. It seems that recurrent subarachnoid hemorrhages with recovery, with or without sequelae, are more likely to be the result of vascular malformations than of aneurysms. Aneurysms are more likely to be fatal during the first attack or the second.

Ligation of the common carotid carries practically no risk. Surgical treatment, whether ligation alone or in combination with deep radiation, will prevent recurrence in many cases.

Seven roentgenograms.

S. B. FEINBERG, M.D.
University of Michigan

Spontaneous Subarachnoid Hemorrhage of Aneurysmal Origin. Factors Influencing Prognosis. Wallace B. Hamby. J. A. M. A. **136:** 522–527, Feb. 21, 1948.

This report is based on a study of the records of 130 patients suffering from subarachnoid hemorrhage, without obvious cause for bleeding or known pre-existing disease. Seventy-five were women and 55 men. The ages varied from seven months to eighty years, with the majority of patients in the fourth to sixth decades.

The cause was determined in 47 cases (41 at necropsy and 6 at operation). Ruptured aneurysm was found in 44 of these. There were 20 aneurysms on the left side of the circle of Willis, 11 on the right, and 15 in the midline. Concomitant intracerebral hematomas were found in 23 of the fatal cases, and in 4 instances were discovered and evacuated at operation.

Head pain was the initial symptom in 69 of the 130 patients; unconsciousness in 42. Neither the activity of the patient at the time of onset nor the age appeared to be of significance in determining the occurrence of the condition or its severity. Death favored neither sex.

The fate of the patients may be summarized as follows: Of 98 admitted in a primary attack, 44 died (45 per cent); of 32 admitted in a secondary attack, 23 died (72 per cent). Sixty-eight patients had a single attack of bleeding in the hospital, and 26 (38 per cent) of these died; 61 had multiple attacks of bleeding in the hospital, with 40 deaths (65.5 per cent). Sixty-seven patients died during hospitalization. Of the remainder, 21 were well at the time of this report; 13 were working, but with neurologic handicaps; 11 were neurologic cripples; 3 had died of unrelated causes, and 1 was not followed. Fourteen had a final fatal hemorrhage.

Six illustrations; 4 tables.

S. B. FEINBERG, M.D.
University of Michigan

About the Angiographic Visualization of the Posterior Cerebral Artery, Especially by Intracarotid Injection of Contrast. Arne Engeset. Acta radiol. **30:** 152–162, Aug. 31, 1948.

The author presents some anatomical facts and problems of interpretation in connection with the angiographic visualization of the posterior cerebral artery. For the preliminary study here recorded he reviewed angiograms of 438 patients, in 23.5 per cent of whom the posterior cerebral artery was visualized. Fifty cases were selected for study of the angiographic anatomy, in 35 of which angiograms were made in 2 planes and in 3 bilaterally. In some cases a percutaneous technic was used, while in others angiography was done after exposure of the carotid arteries. All the cases came from neurologic and neurosurgical services. Unfortunately a selected normal series was not available for study.

In many of the lateral views the posterior cerebral artery was beautifully demonstrated. It was more difficult to discern it in the frontal projection. By tilting the tube about 10 degrees cranially, however, a better view was obtained, and this technic is advocated as a routine. If there is doubt as to the distribution of the posterior cerebral artery or its branches, a 35-degree tilting of the tube cranially is advised. The pictures thus obtained are inspected in the dark room before removal of the needle, and special exposures may then be made as indicated.

The author describes the anatomical findings in both the lateral and frontal views. Usually in the *lateral view* the posterior communicating artery was seen to form a small arch between the carotid siphon and a point corresponding to the anterior part of the posterior cerebral artery. The main trunk of the latter artery was seen as a direct continuation of the communicating artery, ending usually in a bifurcation, projected over the temporal bone, as described by Egas Moniz. A *frontal view* in a presumably normal case showed the posterior communicating artery proceeding medially. Arising from its probable termination, the posterior cerebral artery appeared as a "laterally convex bow," ending in a typical bifurcation and surrounding the brain stem.

Excellent roentgenographic reproductions, 8 in number, accompany the article, and a complete bibliography is appended. E. S. KEREKES, M.D.
University of Arkansas

The Tentorial Pressure Cone, Its Significance and Its Diagnosis Through Dislocation of the Calcified Pineal Body. Bengt Lilja. Acta radiol. **30:** 129–151, Aug. 31, 1948.

The tentorial pressure cone is described as the pressing of brain substance into the incisura tentorii. Here is the "cisterna ambiens" surrounding the mesencephalon dorsally, and bounded laterally by the edge of the arachnoid attached to the inferior side of the cerebrum followin the free edge of the tentorium. The pineal body, situated immediately in front of the "cisterna ambiens," is particularly subject to dislocation as it follows the brain substance when the latter presses downward and backward. Roentgen demonstration of such pineal dislocation, when calcification of the gland permits its demonstration (in about 50 per cent of adults), is thus a definite indication of a tentorial pressure cone. It occurs frequently in the presence of supratentorial expansive processes and may cause symptoms from the brain stem, the pyramidal tracts, and the vessels of this region.

In 1939 the author offered a method of determining the position of the pineal body based on statistical calculations in relation to the size of the cranium. The method presented here is a simplification of that described earlier. It involves the measurement of 6 radii, from the pineal to (1) the sphenoid (front border of sella turcica), (2) the supraglabella, (3) the bregma, (4) the vertex, (5) the deepest posterior part of the occipital fossa, and (6) the opisthion. These radii are expressed in percentages of the normal anteroposterior and superior-inferior diameters as measured from the glabella to the lambda and from vertex to opisthion, respectively. Radii one and two, anteriorly, and radius five, posteriorly, are expressed as percentage of length, while radii three and four, superiorly, and radius six, inferiorly, are expressed as percentage of height of the cranium. For such a study, two projections at right angles are required: a frontal projection for demonstration of a possible lateral displacement and a lateral view to determine the position in the median-sagittal plane.

The method was used in a series of 217 cases of verified tumors and the results are graphically presented.

Three roentgenograms; 3 drawings; 12 graphs; 1 table. JOE B. SCRUGGS, JR., M.D.
University of Arkansas

Diagnosis of Suprasellar Tumors by Pneumoencephalography. N. S. Schlezinger and J. George Teplick. Am. J. Roentgenol. **60:** 213–218, August 1948.

This article is based on the study of pneumoencephalograms in 5 patients with suprasellar neoplasms. Four of the tumors were surgically proved meningiomas and the fifth, in all probability, was an hypophyseal duct tumor. In all there was a striking alteration in the appearance of the cisterna chiasmatis, best described as obliteration.

It has been found that normally the optic chiasm usually occupies a position directly above the diaphragma sellae, while in a small percentage of cases it is located above and posterior to the dorsum sellae. The cisterna chiasmatis lies beneath and behind the chiasma and is usually visualized just above the hypophysis. It is demonstrable in 95 per cent of normal encephalograms, varying in depth "from a potential space to a level of 10 mm." (Schaeffer: Anat. Rec. **28:** 243, 1924). Its obliteration, in the presence of suggestive clinical findings, warrants the presumptive diagnosis of suprasellar tumor.

Hypophyseal adenomas, hypophyseal duct neoplasms, and meningiomas are the tumors most commonly observed in the suprasellar region. Aneurysms of the internal carotid, anterior cerebral, and anterior communicating arteries are not infrequent. Gliomas of the optic chiasm are being reported in increasing numbers. Optochiasmatic arachnoiditis is also capable of obliterating the cisterna chiasmatis.

Eight roentgenograms.

JOSEPH D. CALHOUN, M.D.
University of Arkansas

Brain Tumors in Children. Lyle A. French. Minnesota Med. **31:** 867–874, August 1948.

The author has reviewed the cases of brain tumor occurring in children of sixteen years of age or younger which were seen at the University of Minnesota Hospitals from 1931–1946. He has limited this study to children because of the dissimilar features of tumors in the two age groups, childhood and adulthood. His series includes 146 cases, 17.8 per cent of the brain tumors seen at the University Hospitals in the period under consideration.

The article covers the frequency, histological type of tumor, symptomatology and roentgenography in these cases. Roentgenograms of the skull revealed evidence of increased intracranial pressure in 80 per cent of the children with brain tumors, consisting of: (1) widening of the cranial sutures, (2) increased convolutional markings, and (3) erosion of the sella. Abnormal intracranial calcification was visible in 20 per cent of these children, and was an accurate indication of the localization of the tumor. Ventriculograms were of localiz-

ing value in 78 per cent of the cases in which such studies were performed.

One graph; 4 tables.

D. R. BRYANT, M.D.
The Henry Ford Hospital

Agenesis of Corpus Callosum in Infancy: Clinical and Roentgenological Aspects. Elias Savitsky and Vincent A. Spinelli. Am. J. Dis. Child. **76:** 109–115, July 1948.

A case of complete agenesis of the corpus callosum in a 6-month-old infant is reported. Diagnosis was made *in vivo* from ventriculographic examination and was confirmed at necropsy. The roentgenologic criteria based on air encephalograms were formulated by Davidoff and Dyke (Am. J. Roentgenol. **32:** 1, 1934) as follows: (1) lateral ventricles widely separated; (2) dorsal margins of lateral ventricles pointed or angular rather than flat; (3) medial borders of lateral ventricles concave; (4) caudal portions of lateral ventricles dilated; (5) interventricular foramens elongated; (6) third ventricle dilated and extending dorsally beyond the normal limits; (7) air shadows on medial aspects of cerebral hemispheres showing a radial arrangement of sulci and their extension through the zone normally occupied by the corpus callosum. The only condition which may be confused with agenesis of the corpus from the roentgenologic point of view is a communicating cyst of the cavum septi pellucidi. The characteristic bicornuate appearance of the lateral ventricles may then offer a clue to the diagnosis.

Associated anomalies in the present case were fetal arrangement of medial sulci, microgyria, polygyria, heterotopia, internal hydrocephalus, and granular ependyma.

One roentgenogram; 1 photograph.

Headache: A Common Symptom of Cervical Disk Lesions. Report of Cases. Aidan A. Raney and Rupert B. Raney. Arch. Neurol. & Psychiat. **59:** 603–621, May 1948.

Headache may be associated with pathologic conditions in the neck, among which a cervical disk lesion is quite common. In these cases the symptoms are such that a detailed history will usually suggest the underlying cause and the diagnosis can be established by the physical and roentgen findings. Neurologic examination may show no motor, sensory, or reflex changes. The physical examination will reveal certain points of tenderness in the occipital and cervical regions.

Roentgenograms should include anteroposterior, lateral and oblique views. The initial view should be a lateral teleroentgenogram with the patient sitting in a natural position, without manipulation of the neck. In the early stages of a pathologic process of the cervical disk, lateral tilting of the cervical portion of the spine and segmental straightening or reversal of the cervical curve may be the only characteristic features. Narrowing of the disk space is of significance. Loss of the normal cervical curve is the most consistent abnormality. The roentgenograms must be made at a time when the patient is having maximum pain if these abnormalities of alignment are to be demonstrated.

Exostoses, osteophytes, and arthritic lipping are commonly caused by lesions of the intervertebral disk. Caution must be observed in attributing symptoms of short duration to lesions associated with obviously old osteophytes or lipping.

Four illustrative cases are presented.

Seven roentgenograms; 1 drawing.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Sturge-Kalischer-Weber Syndrome. C. Worster-Drought. Brit. M. J. **2:** 414–416, Aug. 28, 1948.

The rather rare Sturge-Kalischer-Weber syndrome consists of congenital nevi of the face and possibly the body associated with corresponding vascular lesions in the leptomeninges. The meningeal lesions give rise to jacksonian epilepsy, and in some cases hemiparesis, on the opposite side from the cutaneous involvement, since the brain is affected on the same side of the body. Films of the skull reveal calcification such as is usually seen in hemangiomata.

In the case reported here the lesion was bilateral (both cutaneous and meningeal), and the epileptic attacks were generalized. This is believed to be the first bilateral case reported.

Two roentgenograms; 2 photographs.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Intraocular Foreign Bodies in Naval Personnel. Hugo Lucic. California Med. **69:** 114–119, August 1948.

A study is presented of 68 cases of intraocular foreign bodies seen in a naval hospital between 1941 and 1946. In 40 of the patients the injury to the eye was incurred in active combat and in the remaining 28 at work or during the course of military training. Non-magnetic bodies predominated in the combat group; magnetic bodies in the non-combatants.

Roentgen examination is indicated whenever there is any suspicion that the eye has been struck by a foreign body, even though no sign of injury can be found clinically. Various exposures may be required, since small particles may not be demonstrable in all projections. Vogt's bone-free method, in which small dental films are pushed deeply into the orbit at the nasal angle, with the orbit then photographed from an anterolateral position, is sometimes useful. For localization, the authors have used the Comberg method. A contact lens with four lead marks is placed over the cornea, and two exposures (postero-anterior and lateral) are made. The foreign body is localized with reference to the central point by drawing lines between the shadows of the marks. The line from the foreign body to the center determines the globe meridian, and the lateral view determines the distance of the particle from the plane of the limbus. Results are then plotted on a chart.

One of the difficulties involved in the use of the contact lens method has been the degree of error with regard to particles in the periphery of the globe. This has been eliminated by injecting air into Tenon's space, which produces a contrast between globe and surrounding tissue. Another difficulty is the tendency of the lens to slip. This is avoided by a modification of the lens in which suture holes are drilled at its periphery, so that it can be anchored (Thorpe: Arch Ophth. **32:** 497, 1944).

Several cases of opaque and non-opaque foreign bodies in the eye are reported with details as to roentgen findings and treatment.

Six illustrations, including 2 roentgenograms.

MAURICE D. SACHS, M.D.
Cleveland, Ohio

THE CHEST

Unusual Pulmonary Complications Resulting from Prolonged Lodging of Nonopaque Foreign Body in Left Main Stem Bronchus. Arthur Q. Penta. Arch. Otolaryng. **48:** 233–237, August 1948.

A case is reported to illustrate the gamut of pulmonary complications which may follow the prolonged retention of a non-opaque foreign body in the left main stem bronchus.

A 10-year-old boy was admitted to the hospital with a marked elevation of temperature and with a history of sudden attacks of coughing and bronchial wheezing for several days. A roentgenogram was interpreted as suggesting a slight bronchopneumonia. Penicillin and symptomatic therapy were immediately begun. Three days later, general mediastinal subcutaneous emphysema developed, involving the entire front and back of the chest and fascial planes of the neck and extending to the supraciliary regions. Roentgenograms showed diffuse emphysema of the chest and cervical regions. (This complication is seldom seen with smooth foreign bodies, but it is thought that the violent coughing may have produced a slight rupture of the bronchial wall, allowing air to enter the interstitial tissues.)

The patient's condition became progressively worse. Roentgenograms taken two weeks after admission revealed an obstructive emphysema of the entire left lung. The possibility of a foreign body was still not considered. Six weeks after admission, roentgen study of the chest showed a complete atelectasis of the left lung and films a few days later revealed fluid in the left lower part of the chest. Finally, a bronchoscopic examination was made and a foreign body, the rubber sac of a fountain pen, was found completely obstructing the left main stem bronchus. Following its removal, the patient made an uneventful recovery and was discharged on the seventh day. Roentgenograms taken three weeks after the removal of the foreign body showed that the lung had completely regained its normal function.

Six roentgenograms; 2 photographs.

Pulmonary Pathology as Related to Infant Resuscitation. W. Schwab, H. D. Eastman and B. Etsten. New York State J. Med. **48:** 1703–1708, Aug. 1, 1948.

This paper is based on a study of 33 newborn babies. Roentgenograms of the chest were taken immediately at the time of birth, after initiation of respiration, one hour after active respiratory effort, and five days later.

Twenty-one films were obtained before the infants started to breathe. All showed acute angulation of the ribs with the spine, narrow intercostal spaces, and uniform density of the thorax, without delineation of the intrathoracic structures. A funnel-shaped contour of the thoracic cage—constriction superiorly and flaring below—was noted in all.

Roentgenograms were obtained in 12 subjects after the initial respiratory effort. These showed that the lateral borders of the lungs are first to be aerated. The changes in appearance of the chest films after active breathing occurs are striking. The preventilatory funnel-shape is lost, and the intrathoracic structures are demonstrable. Air in the intestine varied with the vigor of respiratory effort. The subsequent roentgenograms showed no further changes in the lung fields.

Various cases are described in detail, including atelectasis of the newborn, bilateral atelectasis in a premature baby with a right pneumothorax, and a case of clinically marked respiratory obstruction in which the chest films were normal and the tracheobronchial tree was patent. It is shown that pathologic intrathoracic entities cannot be demonstrated in the roentgenogram before the initiation of respiration, and that in a fetal type of atelectasis, gentle, prolonged insufflation is safer than direct application of positive pressure. In asphyxia pallida an endotracheal tube for the purpose of inflating the lungs directly is recommended. Atelectasis of the full-term baby can be actively treated by endotracheal suction and insufflation.

The value of roentgenograms of the newborn baby that is having respiratory difficulties is shown to be great.

Eight roentgenograms; 1 photograph.

ALTON S. HANSEN, M.D.
Peoria, Ill.

On the Roentgenologic Picture of Pulmonary Edema. Selmer Rennæs. Acta radiol. **30:** 169–176, Aug. 31, 1948.

The roentgen picture of pulmonary edema has been described by various authors in the last two decades. The heart, as a rule, is enlarged, while symmetrical more or less confluent, perihilar ill-defined patches of increased density are seen. The opacities are usually centrally located, with the pulmonary apices, pericleural borders, and bases relatively clear. The bronchi stand out clearly and the vascular markings are not seen.

X-ray examination alone is not entirely conclusive. Bronchopneumonia and multiple hemorrhagic infiltration of the pleura and lungs may also show widespread opacities in the lungs. Differentiation from passive pulmonary congestion is also a problem. In this latter condition there is an overfilling of the blood vessels, the bases are most often involved, and there may be an associated pleural exudate. In chronic cases, fibrotic changes or calcifications may be scattered throughout the lungs. In some cases edema may develop as a result of passive congestion. It may be found, however, without signs of congestion.

Three cases are presented. In all, autopsy was performed and the diagnosis of pulmonary edema was verified.

The basic principle in pulmonary edema is the anoxia which occurs in the pulmonary tissue with a resulting permeability of the alveolar walls and edema as the end-result. Except for cyanosis and dyspnea, the x-ray findings are far more pronounced than the physical findings. The diagnosis is made on the finding of involved central areas surrounded by air-containing tissues.

Six roentgenograms.

C. S. POOL, M.D.
University of Arkansas

Pulmonary Atelectasis in Stuporous States. A Study of Its Incidence and Mechanism in Sodium Amytal Narcosis. Roy Laver Swank and Magnus I. Smedal. Am. J. Med. **5:** 210–229, August 1948.

Detailed roentgen studies were made of 50 of a group of 300 patients with combat exhaustion, who were being treated with continuous sodium amytal narcosis. In 28 cases these studies were complete and technically satisfactory in all respects. The first 10 cases showed only the basic changes characteristic of deep narcosis: (1) symmetrical elevation of the diaphragm; (2) col-

lapse of the chest cage (*i.e.*, a narrowing of the rib interspaces and an increasing slope of the ribs such as one sees in the expiratory phase of respiration); (3) decreased aeration of the lungs. The remaining 18 patients presented further pulmonary changes, consisting of (1) asymmetrical elevation of the diaphragm; (2) patchy, irregular densities in the lung fields; (3) minimal changes in the symmetry of the chest cage. This latter observation was very difficult to evaluate but is probably of the least practical importance. In 14 of these patients the pulmonary changes disappeared or diminished strikingly in twenty-four hours or less. Sometimes patches of atelectasis cleared in one lung only to reappear later in the other. Sometimes the densities were so minimal that their nature could be interpreted only by comparing films taken on successive days. In the remaining 4 patients the pulmonary changes were more marked and the fever was higher. In 2 patients the atelectasis disappeared in forty-eight hours; in the remaining 2 it persisted for four and six days after narcosis.

During the first twelve hours of deep narcosis, the body temperature usually fell 1 to 2° F. Subsequently, it rose, being higher on the second and third days than on the first. In patients with focal as well as general lung changes, the fever was usually higher than in those exhibiting decreased aeration alone. Significant changes in respirations during fever occurred in only a few patients with severe pulmonary lesions. There was a direct correlation between the degree and frequency of fever and depth of narcosis. The mechanism of the fever is probably not infectious. It is suggested that a failure of heat loss through the lungs as a result of hypoventilation and from the skin as the result of cutaneous vascular insufficiency may be a factor.

The mechanism of the pulmonary changes seems to be, first, compression of lung tissue due to a collapsed chest and high diaphragm; this decreases the diameter of the smaller airways and probably lessens or stops the collateral circulation of air from one to another alveolus by way of the interalveolar ostia. Second, the smaller airways become blocked and lobular atelectasis develops. Anoxia and hypercapnia contribute to this by increasing the fluid content of the smaller airways.

Sixteen roentgenograms; 4 charts; 2 tables.

Atelectasis of the Left Lung Produced by an Aortic Aneurysm. J. P. Garaix. J. franç. de méd. et chir. thorac. **2:** 469–470, 1948. (In French)

A forty-nine-year-old male complained of mild hemoptysis for a few days. There had also been a change in the timbre of his voice for the past few months. Fluoroscopic and radiographic studies of the chest showed a massive atelectasis of the left lung. The blood pressure was 160/110 mm. A clinical diagnosis of a primary neoplasm of the left main stem bronchus was made and bronchoscopy was resorted to for confirmation of this opinion.

On examination of the larynx the left vocal cord was normal in structural appearance but was found to be paralyzed. The left main stem bronchus, 2 cm. below the carina, was completely stenosed. The mucosa was mildly edematous, but no foreign body or neoplasm was found. A biopsy was attempted and was immediately followed by a massive hemorrhage with death in a few seconds.

Autopsy revealed a large aneurysm arising from the concavity of the aortic arch producing stenosis of the left main stem bronchus and atelectasis of the left lung. At the point of contact between the aneurysm and the bronchus, a thin sheet of fibrous tissue, less than 1.0 mm. in thickness, separated the aorta and the bronchus.

In the presence of a smooth-walled stenosis of the left main stem bronchus, it is therefore wise to be exceedingly cautious in procuring biopsy material, even when there is no clinical evidence suggesting aneurysm.

Two roentgenograms. E. M. SAVIGNAC, M.D.
Detroit, Mich.

Transient Pulmonary Infiltrates. M. Delord. J. franç. med. et chir. thorac. **2:** 317–336, 1948. (In French)

The author defines transient pulmonary infiltrates as shadows of varying degrees of opacity without a clear central zone, without atelectatic features, occupying only a portion of a pulmonary lobe, and completely clearing in less than six weeks of time. These infiltrates are not the result of any specific disease entity. They are seen chiefly: (1) during the evolution of lobar and bronchopneumonia; (2) in bronchial disorders, such as bronchiectasis, and low-grade non-malignant bronchostenoses; (3) in pulmonary tuberculosis; (4) in Loeffler's syndrome; (5) in certain parasitic or infectious diseases, as ascaris infestation, staphylococcic pneumonias, and primary atypical pneumonia. The exact histologic picture is not known because, by definition, complete recovery occurs and detailed study is not possible. Bronchoscopically, the orifice of the involved bronchus is seen to be reddened, with edema of the mucosa, and usually scanty thickened secretions are aspirated.

The author also states that Loeffler's syndrome is not a specific disease but is found accompanying a rather long list of ailments characterized by eosinophilia.

Histories are included of several cases in which the infiltrates resolved completely within the specified period of time, but in which the tubercle bacillus was isolated. These were all reinfection types of tuberculosis. Again in several patients undergoing sanatorium care for known tuberculosis, infiltrates appeared and resolved without any recognizable connection to the tuberculous process. It is therefore important not to conclude with finality that each and every fresh, soft, infiltrate in a chronic tuberculosis is tuberculous in character; frequently, a watchful attitude for a few weeks will lead to a different interpretation.

Three roentgenograms. E. M. SAVIGNAC, M.D.
Detroit, Mich.

Transient Pulmonary Consolidation in Mass Radiographic Surveys. Analysis of 102 Cases. Ju-Sheng Tsai and Philip T. Y. Chiu. Chinese M. J. **66:** 421–425, August 1948.

This report is based on mass fluoroscopic surveys of the chest in the Peiping Tuberculosis Center. If a suspicious lesion is found, x-ray films are made. In over 72,000 fluoroscopic examinations covering a two-year period, 4,500 films were required. A group of 102 cases was classified as representing "transient pulmonary consolidation." These cases were closely followed, for the most part at intervals of two weeks.

The pulmonary shadow in this group of cases usually extended from the hilus toward the periphery, involving only a portion of a lobe. In most cases it was of

moderately homogeneous density, with the border fading into the surrounding lung. The size varied. The most frequent site was the right lower lobe, followed in order of frequency by the right middle, right upper, left lower, and left upper lobes.

Sixty-three per cent of the group were young people, predominantly males. Cough and fever were common symptoms, but physical signs were negligible. The sedimentation rate was usually normal. Other laboratory findings are not discussed.

In most cases the shadow cleared in two to four weeks; in a few it lasted as long as two months.

The authors are vague about the diagnostic possibilities, but they believe that most of their cases were related to an upper respiratory infection. One note of warning is sounded: The diagnosis of pulmonary tuberculosis in surveys among the apparently healthy often needs a great deal of caution, particularly when the shadow is in the middle or lower lobes. Serial films may show disappearance of the lesion in two to four weeks. This is the most significant differential diagnostic criterion.

Four tables. EDWARD E. LEVINE, M.D.
Dearborn, Mich.

On the Different Forms of Phthisiogenous Infiltrates and the Development of Phthisis. Niels Christiansen. Acta radiol. **30:** 17–35, Aug. 31, 1948.

The author discusses the history of the discovery of tuberculosis as a distinct entity and reviews the work done in this field, with special emphasis upon Scandinavian contributions. The different types of infiltrative processes forming the starting point for tuberculosis, as manifest radiologically, are listed under three headings: exogenous, endogenous, and residual or interval forms.

The primary complex is described as a caseous pneumonia surrounded by the elementary tubercles (constituting the primary focus of the disease) in connection with regional hilar adenitis. An allergy to the tubercle bacillus is set up by this primary complex.

The caseous content of the primary focus may penetrate into a bronchus and be expectorated *in toto;* it may indurate and calcify; it may penetrate a bronchus and produce a bronchogenous spread of the disease; or, lastly, it may be of a fulminating nature within itself.

The author concludes that: (1) most pulmonary tuberculosis develops either directly from primary infiltrates or from early bronchogenous infiltrates; (2) that tuberculosis may develop from persistent foci subsequent to hematogenous spread; (3) that apparently inactive infiltrates in periods of reduced resistance may reactivate and form a fulminating, destructive tuberculosis.

Several cases are reported.

Nineteen roentgenograms.

JOE B. SCRUGGS, JR., M.D.
University of Arkansas

Pulmonary Tuberculosis in the Old. F. J. Hebbert. Lancet **2:** 247–249, Aug. 14, 1948.

A study was made of 69 cases of pulmonary tuberculosis in patients over sixty years of age, from the general wards of a hospital with a fairly high admission rate of older patients. Sixty of the patients were men. This high percentage is attributed in part to the fact that many old men live in lodging houses and similar places, and of necessity go to the hospital with ailments which call for nursing. Most of the men had done heavy manual work.

Cough, loss of weight, and hemoptysis were the principal symptoms. In 34 cases, or almost half, tubercle bacilli were found in the sputum by examination of routine smears; in 30 cases which gave negative results, examinations were insufficient to exclude the presence of tubercle bacilli.

Roentgen reports were available in 57 cases. Fibroid disease was present in 29, bilateral in 15. Active (fibrocaseous) disease, sometimes accompanied by fibroid disease elsewhere, was found in 24 cases; this was bilateral in 8. Pleural effusion was observed in 5 patients, tuberculous bronchopneumonia in 2, extensive fibrosis with mediastinal shift in 4, diaphragmatic adhesions in 1, bronchiectasis in 1. In 1 miner, anthracosis with a fibroid lesion was diagnosed.

No treatment beyond rest and symptomatic measures was employed; none of these patients were admitted to sanatoria.

The author believes that more attention should be directed to the problem of pulmonary tuberculosis in the aged, as this is often an active process with a high proportion of sputum-positive cases.

Tuberculosis in the Feebleminded. Peter A. Theodos. Am. Rev. Tuberc. **58:** 237–249, August 1948.

The results of a study concerning the incidence of tuberculosis among patients in a 2,400-bed institution for the feebleminded are reported. During the six-year period from 1932 to 1938 it was found that each year, on an average, 28.4 per cent of deaths were caused by tuberculosis. In 1938 and 1939 a total of 1,733 patients were intensively studied for evidence of this disease; of these, 81.6 per cent reacted positively to the tuberculin test. Of the positive reactors 142, or 8.2 per cent, were found to have lesions characteristic of the reinfection type of pulmonary tuberculosis and 77 of these were considered to have clinically significant disease. The rate of tuberculous disease was found to be in direct proportion to the degree of mental deficiency, being highest in the idiot class.

Re-examination of the diagnosed cases seven years after the original survey showed that 50.6 per cent of the patients with clinically significant disease had died. In those thought to have had healed disease, 17.2 per cent died from tuberculosis and an additional 17.3 per cent showed reactivation of their disease. Since the survey, 1,640 routine admission examinations have shown an incidence of 1.03 per cent clinically significant lesions.

The use of BCG vaccination as a prophylactic measure should be considered in this type of institution where the infection rate is so high.

Seven tables; 1 chart. L. W. PAUL, M.D.
University of Wisconsin

Bronchial Tuberculosis Simulating Foreign Body in a Child One Year of Age. Report of a Case. Porter P. Vinson. Am. Rev. Tuberc. **58:** 207–209, August 1948.

A case is reported in which bronchial tuberculosis produced the signs and symptoms of an aspirated foreign body of a one-year-old child. The history suggested the possibility of such an episode, and roentgen examination revealed an obstructive type of emphysema involving the right lung. On bronchoscopic examination the

right main bronchus was found to be completely occluded by a mass of granulation tissue. Acid-fast organisms were found in stained sections of this tissue.

Two roentgenograms. L. W. PAUL, M.D.
University of Wisconsin

Blunt Trauma to the Thorax and Tuberculosis of the Lung. P. Masson. Schweiz. med. Wchnschr. **78:** 677–681, July 17, 1948. (In German)

The author reports two cases in which a blunt injury to the chest led to an active pulmonary tuberculosis. In the first case a lung abscess developed two weeks after a blow to the thorax. This apparently involved an inactive tuberculous focus, and the clinical picture changed from that of a typical pyogenic abscess to that of a cavernous tuberculosis. Local improvement followed induction of pneumothorax, but there was cross-spread to the opposite lung.

The second patient had an active right apical tuberculosis in 1941, with prompt clearing, confirmed by numerous fluoroscopic check-ups. Four years later, following a powerful pull on the right arm, he had a hemoptysis beginning about fifteen minutes after the injury. Subsequent symptoms were scanty, but six months later an active cavernous tuberculosis was demonstrated in the right apex at the site of the old lesion.

Six roentgenograms. LEWIS G. JACOBS, M.D.
Oakland, Calif.

Treatment of Tuberculosis with Streptomycin. Response of Certain Subacute and Chronic Types. Kirby S. Howlett, Jr. and John B. O'Connor. Am. Rev. Tuberc. **58:** 139–172, August 1948.

Results of a study on the effects of streptomycin in the treatment of certain types of subacute and chronic tuberculosis are reported. The two types which furnished most of the material for study were: (1) chronically unstable tuberculosis of limited extent with continued activity and sputum positive for tubercle bacilli in spite of prolonged treatment by conventional methods; (2) subacute and chronic disseminated nodular pulmonary tuberculosis which failed to respond to treatment by bed-rest.

In the first group streptomycin caused temporary improvement in most of the patients. Response, however, was not uniform, and relapses have already been observed in some cases. In those patients with disseminated or nodular lesions the response was unequivocal and marked. The evidence suggests that in this type of disease streptomycin and continued bed-rest may be all that is needed to produce arrest of the process, provided collateral caseation or cavitation does not exist.

Twenty-three roentgenograms; 4 tables.

L. W. PAUL, M.D.
University of Wisconsin

Minimal Requirements for Mass Radiography. F. C. S. Bradbury. Lancet **2:** 293, Aug. 21, 1948.

According to the author, there is a lower limit to the efficiency of mass radiography, below which it becomes uneconomical. It is suggested that a practical measure of this lower limit would be the point where the survey leaves undiscovered more tuberculosis than it discovers. On this basis it is shown that not less than 70 per cent of any group to be surveyed should actually be examined to make the survey worth while. This figure is arrived at by an analysis of five surveys in Lancashire County, England.

Photofluorographic Survey of 33,971 Apparently Healthy Persons in Greece. Basil Papanicolaou. Dis. of Chest. **14:** 585–595, July-August 1948.

The author gives the findings in a mass survey in Athens, Greece, of 33,971 apparently healthy persons, selected from the Armed Forces, students, personnel of Public Services, personnel of so-called "mixed enterprises" (public utilities), factory workers, and a special group including displaced persons, prisoners, registered prostitutes, etc. The number included 6,511 females and 27,460 males; 1,091 persons, or 3.21 per cent, were found to have clinically significant tuberculosis. The incidence for males was 3.28 per cent and for females 2.93 per cent. The males constituted 80.9 per cent of the examinees and provided 82.4 per cent of the clinically significant cases. Their incidence curve increased with age, while among the females the highest incidence occurred between twenty and thirty years.

The incidence of clinically active cases for the various groups was as follows: Armed Forces (13,582 examinees), 1.54 per cent; students (3,658 examinees), 3.38 per cent; public services (6,382 examinees), 4.62 per cent; "mixed enterprises" (4,889 examinees), 4.97 per cent; factories (3,328 examinees), 4 62 per cent; special group (2,132 examinees), 3.09 per cent. The highest rate was observed among displaced persons, 13.67 per cent.

Of the 1,091 cases, 607, or 55.6 per cent, were minimal; 416, or 38.1 per cent, were moderately advanced; 68, or 6.3 per cent, were far advanced. Newly discovered cases numbered 732 (67 per cent); of these, 45 per cent were moderately advanced and 9 per cent far advanced.

On the basis of the statistical findings, the incidence rate of tuberculosis among the urban population of Athens is estimated to be about 3.5 per cent.

Three charts; 3 tables.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Benign Pulmonary Histoplasmosis. A Case Report With a Brief Review of the Literature. Hollis E. Johnson and Randolph Batson. Dis. of Chest **14:** 517–524, July-August 1948.

In a 64-year-old farmer, of Northern Alabama, a roentgenologic diagnosis of pulmonary tuberculosis with cavitation was made. There was no history of contact with the disease, and repeated sputum examinations and skin tests (0.1 mg. and 1.0 mg. O.T.) for tuberculosis were negative. A skin test using 1.0 mg. coccidioidin was also negative, but a histoplasmin test (0.1 c.c. of 1:100 dilution) was positive, and colonies of *Histoplasma capsulatum* were found in the sputum. The patient did well under rest and general supportive measures. The disease was limited to the lungs and apparently was benign in character.

Very little is known of the pathogenesis of histoplasmosis. The organs most frequently involved are the spleen, liver, visceral lymph nodes, lungs, bone marrow, oral mucosa, adrenals, gastro-intestinal tract, peripheral lymph nodes, kidneys, and larynx. The symptoms vary. With pulmonary involvement, they are similar to those of pulmonary tuberculosis. Histo-

plasmosis should be considered as a possibility wherever there is fever, nodular or ulcerated lesions of the skin or mucous membranes, generalized lymphadenopathy, hepatosplenomegaly, anemia, leukemia, and a low blood pressure.

One roentgenogram; 1 table.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Silicosis. Carl E. Ervin, Dale C. Stahle, and Peter B. Mulligan. Pennsylvania M. J. **51:** 1209–1214, August 1948.

Silicosis among coal miners "is undoubtedly the most important occupational disease confronting the physicians of Pennsylvania." All miners are apparently not equally susceptible to "miner's asthma," and it is the opinion of the essayists that mouth breathers develop it more readily because part of nature's defenses have been by-passed. When one studies the defense mechanism of the respiratory tract, it is not surprising that individuals can withstand great quantities of dust through long years of exposure. In arriving at a diagnosis of silicosis, one must be sure that the cause of the patient's complaints is not arteriosclerosis or one of the many degenerative diseases common to men after the age of fifty or sixty.

It has been determined that, in order for silica to be harmful, it must occur in excess of 5 million particles, per cubic foot, measuring less than five microns.

The reaction of lungs to silica dust has been extensively studied. It appears that where silica concentrations become too high, the phagocytes collect in aggregates, break down, and become necrotic. The necrotic areas become fibrous and, as they increase in number, coalesce. These areas become connected by fibrous bands, which result in collapse of the air sacs between them.

Acute silicosis may occur and cause death in two or three years. The only x-ray finding in such cases is a generalized haziness of both lungs. This occurs only after exposure to great concentrations of silica dust.

The usual beginning complaints are shortness of breath, cough, and weight loss. The chest film first shows discrete nodules which, as pointed out above, become larger and more numerous. The normal lung becomes eventually emphysematous. Spontaneous pneumothorax may follow rupture of pleural blebs.

The diagnostic aspects of the disease are discussed at length.

Two roentgenograms.

JOSEPH T. DANZER, M.D.
Oil City, Penna.

Silicosis as Viewed by an Internist. W. Bernard Yegge. Dis. of Chest **14:** 550–567, July-August 1948.

The author discusses the etiology, symptomatology, classification, prevention, and treatment of silicosis. Included in the article are case histories, with roentgenograms, illustrating conditions simulating silicosis, variations in the character of the lesions following almost identical exposure, extension of the lesions after removal from exposure, and also cardiac and tuberculous complications. In one case a cardiac decompensation was diagnosed silicosis because of the occupation; in another a polycythemia and cardiac failure were the disabling factors even though silicosis was present, and in a third a silicosis was incorrectly diagnosed as lung tumor. Two patients with six years of occupational exposure showed considerable differences in the roentgen appearances of the silicotic lesions.

It is pointed out that not all persons exposed to silica develop silicosis; also that symptoms and physical signs may be lacking in the presence of advanced silicotic lesions.

Twenty-eight roentgenograms.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Primary Atypical Pneumonia: Roentgenographic Course, Complications, Recovery Rate, and End Results. Alvin C. Wyman. Dis. of Chest **14:** 568–579, July-August 1948.

The etiologic factor of a pulmonary inflammatory process is a clinical problem, and not radiological. The roentgenogram is an aid in determining the location and extent of the process, the efficacy of therapy, the recovery rate, and the presence of complications and sequelae. The present study is a statistical analysis of 855 cases of atypical pneumonia occurring at a large naval recruiting center. The object of the study was to determine from a roentgenological point of view whether the distribution of involvement in primary atypical pneumonia of unknown etiology bore any relation to the course of the disease, the presence of complications, the rate of recovery, and the end-results. The patients were all males, ranging in age from seventeen to thirty-five years.

The study revealed that there is little predictability in any case. The distribution of involvement was found to bear no notable statistical relationship to the course, including the incidence of recurrence and reinfection. In 676 cases or 79.1 per cent, a single lobe was involved; in 75.2 per cent of all the cases there was involvement of one or both lower lobes, with almost equal incidence in the other three lobes. The general over-all average roentgenographic recovery time was 15.2 days, with no correlation between lobe involved and recovery time in uncomplicated cases. An average of four days more was required for clearing if pleurisy or effusion were present. Complications developed in 108 cases: pleurisy in 35, pleural effusion in 64, atelectasis in 6, subcutaneous emphysema in 1, pericardial effusion in 1, pneumothorax in 1. The end-results showed complete clearing in 778 or 90.9 per cent, pleural thickening in 48 or 5.6 per cent, localized fibrotic changes in 12 or 1.4 per cent, unproved bronchiectasis in 13 or 1.6 per cent, and proved bronchiectasis in 4 or 0.5 per cent.

Eight tables.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Chronic Nonspecific Suppurative Pneumonitis. A Report of Ten Cases. Richard D. Kershner and W. E. Adams. J. Thoracic Surg. **17:** 495–511, August 1948.

Ten cases of chronic lung disease are reported which the authors believe must be differentiated from tuberculosis, bronchiectasis, lung abscess, and bronchiogenic carcinoma. The onset is insidious and the main symptoms are productive cough, hemoptysis, and chest pain. Duration of symptoms varied from three months to twenty-two years. There is very little weight loss, and the patients do not appear chronically ill. A low-grade fever is a common finding. The etiology is unknown. Bronchoscopy shows inflammation of the bronchial

mucosa and pus in the bronchi in the involved areas. Roentgenograms as a rule show a rather dense lesion, poorly defined, fairly large, usually single and confined to one or two lobes. The differential diagnosis is not possible from roentgenograms alone and can be made with certainty only by biopsy. Recommended treatment is surgical removal, which produces good results.

Twelve roentgenograms; 1 photograph; 3 photomicrographs; 4 tables.

HAROLD O. PETERSON, M.D.
University of Minnesota

Acute Diffuse Interstitial Fibrosis of the Lungs. Report of a Case. Benjamin P. Potter and Isadore E. Gerber. Arch. Int. Med. **82:** 113–124, August 1948.

In 1944, Hamman and Rich (Bull. Johns Hopkins Hosp. **74:** 177, 1944. Abst. in Radiology **43:** 405, 1944) applied the term acute diffuse interstitial fibrosis of the lungs to a comparatively rare condition characterized by an acute clinical course terminating fatally. Potter and Gerber report another case, bringing to 6 the number described to date. The predominant symptoms are progressive dyspnea, cyanosis, and harassing non-productive cough, with death in respiratory failure or in failure of the right side of the heart. The characteristic pathologic feature is diffuse fibrosis of the alveolar walls, with little involvement of the alveolar lumen.

The paucity of pulmonary signs on physical examination in view of the subsequent anatomic findings is explained by the fact that the lesion is predominantly interstitial in location. A fairly constant finding is that of harsh breath sounds. The presence of crackling and moist râles, together with intensified or distant breath sounds, may be due to the focal bronchopneumonia present in some instances in association with the interstitial fibrosis. The disparity between the physical findings and the roentgen appearance is not surprising, since similar features have been noted in so-called virus or atypical pneumonia, in which the anatomic lesion is also predominantly in the interstitial tissue, usually about the bronchi.

Five roentgenograms; 1 photograph; 5 photomicrographs.

Pulmonary Paragonimiasis. Alvin J. B. Tillman and Harry S. Phillips. Am. J. Med. **5:** 167–187, August 1948.

Twelve cases of paragonimiasis were encountered in the Philippine Islands among approximately 250 guerillas hospitalized for observation of tuberculosis. Coexisting tuberculosis and paragonimiasis were established in 4 of these 12 cases.

Eleven patients showed involvement of the lung in the initial roentgenogram of the chest. The twelfth showed extremely heavy peribronchial markings in the initial film and ten days later an area of parenchymal infiltration. The changes seen could be divided roughly into two groups: in one group the involvement was massive and large areas of density were present (6 cases); in the second group the changes were diffuse and the lesions were small, soft, and generally multiple (5 cases). The right lung and the lower lobe were more frequently affected than the left lung and the upper lobe. Both lungs were involved in 5 patients. Invasion of a single lobe was seen in only 4 patients.

The massive lesions in which the x-ray shadow indicated consolidation, abscess cavity, or fluid had no discernible specific characteristics suggesting the presence of paragonimiasis. Frequently small areas of infiltration were present in the upper lobes in these cases, leading to a diagnosis of tuberculosis. In one case these shadows preceded the onset of fluid and were associated with the presence of both tubercle bacilli and typical ova. In another case the shadows followed the appearance of fluid and were also associated with both tubercle bacilli and ova. Within two months after therapy these small areas of involvement were markedly diminished in size in the first case and had entirely disappeared in the other. A small area of infiltration was seen in two other cases complicated by fluid. In neither of these were tubercle bacilli found; in one, typical ova were repeatedly recovered from the pleural fluid.

The etiology of the x-ray shadows in these cases must remain in question in the absence of pathologic examination and prolonged follow-up. The resolution of the lesions in such short periods of observation, if tuberculous, seems most unusual. Tubercle bacilli were found only rarely in spite of assiduous search, and the disappearance of ova and decrease of sputum roughly paralleled the clinical and x-ray improvement. It is likely that the association of tuberculosis and paragonimiasis contributed to the roentgenologic picture, but the subjective relief and decrease of pulmonary symptoms following emetine suggest that the role of the fluke was the more important in this respect.

Paragonimiasis may simulate tuberculosis closely and should be considered in the differential diagnosis of hemoptysis in personnel who have been in endemic regions. Paragonimiasis may also produce serum protein changes and transiently positive serologic tests for syphilis.

Treatment of this disease is still far from satisfactory. Emetine hydrochloride relieved subjective symptoms promptly in the authors' cases, but it had only a slight effect on the pulmonary disorder as indicated by roentgen findings in the period of observation.

Four roentgenograms; 3 tables.

Basal Broncho-Esophageal Fistulae with Pulmonary Abscess. P. Santy, F. Paliard, M. Bérard, P. Galy, and J. Dumarest. J. franç. méd. et chir. thorac. **2:** 351–359, 1948. (In French)

The pathogenesis of broncho-esophageal fistulae, as reported in the literature, is quite varied, involving such factors as cicatricial contractions, various types of inflammatory diseases, and especially bronchial and esophageal cancer. Only a small number of these fistulae have been found in relation to the "traction" esophageal diverticulum of Zenker.

Traction diverticula are almost always found at the level of the tracheal bifurcation or below, on the right side. They are now generally believed to be of inflammatory or cicatricial origin. Among the mediastinal infections most likely to produce these localized tractions of the esophageal wall are the peribronchial adenopathies, especially those of tuberculous character. At autopsy the diverticular sac is found lined by epithelium except for its floor, which is made up of fibrous or lymphoid tissue. From the bottom of this sac a fistulous tract sometimes develops following long periods of alimentary stasis or infection, ending in the air passages, the pleura, or other neighboring structures.

Two case histories are presented in which a primary

infection type of tuberculosis had occurred. Following a latent period of years some dysphagia developed, characterized chiefly by paroxysms of cough after swallowing liquids. Eventually a suppurating pneumonitis occurred, with frank abscess formation. Fluoroscopy with a thin barium suspension revealed broncho-esophageal fistulae originating from an esophageal traction diverticulum. Swallowed methylene blue was recovered in the sputum. A surgical cure was effected in both patients.

Six other cases from the literature are summarized.

Four roentgenograms. E. M. SAVIGNAC, M.D.
Detroit, Mich.

Exploratory Thoracotomy in the Management of Inthrathoracic Disease. John B. Grow, Martin L. Bradford, and Hugh W. Mahon. J. Thoracic Surg. **17:** 480–493, August 1948

Mass x-ray chest surveys have now been used to such an extent that almost everyone has had an opportunity to be examined. From these surveys 1.4 per cent are found to have tuberculosis. Approximately one in eighty-nine show abnormal non-tuberculous findings. It is the final diagnosis of these latter cases that presents a serious problem. From the authors' experience in 200 exploratory thoracotomies, they have arrived at the following conclusions:

The history and physical examination are of little value in making a definitive diagnosis early. Bronchial secretions stained and examined by competent observers will diagnose a large number of the carcinomas early. Other lesions, such as tuberculosis, coccidioidomycosis, histoplasmosis, infectious mononucleosis and blood dyscrasias may or may not be diagnosed by laboratory methods.

X-ray diagnosis is of almost no value in definitely stating the cause of the abnormality seen on the films. Exceptions are dermoid cysts containing teeth, aneurysms shown by diodrast, and diaphragmatic hernias demonstrated by diagnostic pneumoperitoneum. Bronchoscopy can be expected to diagnose less than 50 per cent of all lung carcinomas, and in many of these it will be too late to hope for a cure with surgery.

Diagnostic x-ray therapy is condemned because: (1) all malignant lymphomas do not respond; (2) many benign lymphadenopathies and resectable malignant lesions of the thymus do respond leading to an erroneous diagnosis; (3) the prognosis in localized mediastinal lymphoma may be better with both surgery and radiation; (4) the prompt establishment of a histologic diagnosis expedites initiation of correct treatment.

The risk of exploratory thoracotomy is now so minimal that the authors feel it is the procedure of choice when an absolute diagnosis cannot be obtained by laboratory methods or biopsies. Tables show the types of lesions encountered in the 200 explorations.

Twenty roentgenograms; 3 tables.

HAROLD O. PETERSON, M.D.
University of Minnesota

Nonmalignant Intrathoracic Lesions Simulating Bronchogenic Carcinoma. Report of 30 Operated Cases. Lyman A. Brewer III, Wilfred M. G. Jones, and Frank S. Dolley. J. Thoracic Surg. **17:** 439–461, August 1948.

The authors review 30 cases of non-malignant lung disease in which the lung was removed because cancer could not be ruled out preoperatively. In this group there were 20 inflammatory conditions, 6 benign tumors and 4 developmental abnormalities. After a careful study of the clinical and x-ray findings, the authors are forced to admit that most often the differentiation between peripheral cancer and non-malignant conditions cannot be made without exploratory thoracotomy. Twenty-seven of these 30 patients were cured by the surgery, 2 were unimproved, and 1 died. The authors feel the treatment of undiagnosed lung lesions is similar to the treatment in cases of suspected carcinoma of the breast; namely, exploration biopsy and radical excision if cancer is proved.

Two charts; 42 drawings; 6 tables.

HAROLD O. PETERSON, M.D.
University of Minnesota

Boeck's Sarcoid: Observations on Seven Patients, One Autopsy. Gaylord S. Bates and John M. Walsh. Ann. Int. Med. **29:** 306–317, August 1948.

The clinical records of 7 patients with Boeck's sarcoid are reviewed and the postmortem findings in one case with extensive involvement of the myocardium are included. The diagnosis of the disease is usually not difficult and its infrequent recognition is to be explained by the fact that few physicians have made its acquaintance.

As to the roentgen findings, 5 of the patients in this series showed widened hilar shadows interpreted as evidence of enlarged lymph nodes, and this picture is believed to be an early and important feature of the disease. In one case there was peribronchial mottling, regarded as indicating involvement of the lung parenchyma.

The following points are also made: (1) An elevated serum protein and hyperglobulinemia may serve to suggest the diagnosis of Boeck's sarcoid. (2) Biopsy provides the only certain method of identification. An accessible lymph node will always eventually provide the necessary specimen. (3) The histologic features of sarcoid are definite and usually unmistakable. (4) An elevated sedimentation rate may be an accurate measure of the activity of this disease. (5) A persistent tachycardia should be a warning that the myocardium has been invaded.

Six illustrations; 3 tables.

Besnier-Boeck-Schaumann Disease with Typical Osseous Lesions, Diabetes Insipidus, and Widely Disseminated Tuberculosis, Showing a Remarkable Response to Streptomycin. C. Gernez-Rieux, A. Breton, Bonte, and Delwaulle. J. franç. méd et chir. thorac. **2:** 376–387, 1948. (In French)

The case history of a 23-year-old woman is presented. For nearly ten years she had been almost continuously ill, with a variety of symptoms. When seen by the authors, she presented a bilateral macular choroiditis, a severe diabetes insipidus, a draining tumor of the body of the sternum, an arthritis of the right elbow and right hip, a deformity of the left index finger, and a chronic cough. She was debilitated and malnourished, with anorexia and daily fever reaching as high as 100°.

Roentgenograms revealed the typical appearance of miliary tuberculosis in the lungs and numerous bony lesions characteristic of Boeck's sarcoidosis in the skull, the scapulae, the ribs, the pelvis, and the hips. The elbow joint, the hip joint, and the body of the sternum

showed tuberculous lesions, and pus aspirated from these sites yielded tubercle bacilli which produced death from tuberculosis in injected guinea-pigs.

Streptomycin therapy—42 gm. in a period of seventeen days—produced complete disappearance of the pulmonary lesions and a marked improvement in both the tuberculous and sarcoid bone lesions.

The authors speculate about a possible etiologic connection between tuberculosis, sarcoidosis, and benign lymphogranulomatosis.

Eight roentgenograms. E. M. SAVIGNAC, M.D.
Detroit, Mich.

Rationale of a Functional Treatment for Dilated Bronchi. Jacques Delarue, René Sauvage, and Francis Meunier. J. franç. de méd. et chir. thorac. **2:** 444–459, 1948. (In French)

On careful examination of surgical and autopsy specimens of lungs showing bronchial dilatation, a goodly number reveal complete denudation of the bronchial epithelium while others show an intact epithelial lining with evidence of considerable hypertrophy of the entire mucosa. In the latter type of case the epithelium is made up of a large proportion of mucus-producing cells piled up so profusely on the basement membrane that the epithelium shows a polypoid or villous architecture. Furthermore, the tunica propria is rich in cells and blood vessels, all contributing to the hypertrophy. Patients with such changes frequently expectorate large amounts of sputum which, on staining, is predominantly mucous instead of purulent. Their exacerbations and remissions are not necessarily correlated to bouts of infection but follow a wide variety of precipitating factors. It was thought that the pathologic changes in such cases are not necessarily irreversible. Yet under the prevailing forms of treatment, these patients were subjected either to radical pulmonary surgery or to a somewhat passive form of treatment.

Numerous controversial theories have been advanced to explain dilatation of the bronchi. The authors believe that, because all elements of the lung are involved—muscular, vascular, and supportive—the vegetative nervous system must necessarily play an important role. They consequently began to dissect numerous cadavers in order to trace vegetative nerve fibers to the lung. These revealed a rich anastomosis between the stellate ganglion in the neck and the upper portion of the phrenic nerve. The phrenic nerve trunk carries these autonomic fibers for a distance and they are then distributed to the pulmonary parenchyma. An attempt was therefore made to block both the phrenic nerve and the stellate ganglion in the category of patients described above. Interruption of either nerve structure alone proved theoretically and practically to be unsatisfactory, but when block of both the nerve and the ganglion was performed, seven out of twelve selected patients obtained practically complete relief of their expectorations, two obtained considerable relief, while three were failures. All patients had definite bronchial dilatation with copious amounts of mucoid sputum. After relief of symptoms, bronchograms in every instance showed persistent dilatation of the bronchi.

Four roentgenograms; 2 photomicrographs; 3 diagrams. E. M. SAVIGNAC, M.D.
Detroit, Mich.

Retrocardiac Bronchiectasis. Robert G. Bloch, Louis F. Sandock, and Earl B. Mitchell. Am. J. Roentgenol. **60:** 219–224, August 1948.

In a series of 90 cases of bronchiectasis, 47 showed unilateral involvement, and in 39 of these the disease was in the left lower lobe. Left lower lobe involvement was also predominant in a considerable number of bilateral cases. The predilection for this site is attributed to the traction effect of pericardial adhesions that have resulted from the previous primary pulmonary infection rather than to the configuration of the bronchial tree.

The important diagnostic aspect of these observations lies in the fact that in routine roentgenograms of the chest the greater part of the lung field represented by the left lower lobe is obscured by the cardiac shadow, with the result that bronchopulmonary findings may be absent or minimal. Only bronchograms can reveal the true extent of the disease.

Routine chest films and bronchograms are reproduced, the former showing minimal findings and the latter revealing massive bronchiectasis behind the cardiac shadow. A number of charts are also included.

J. D. CALHOUN, M.D.
University of Arkansas

Spontaneous Mediastinal Emphysema and Pneumothorax. Arthur J. Draper. Am. J. Med. **5:** 59–68, July 1948.

A case of spontaneous mediastinal emphysema with left pneumothorax in a 23-year-old male is reported. Only 42 cases of spontaneous mediastinal emphysema have been recorded in the literature, but it is thought that the condition is much more common than this figure would indicate. Spontaneous pneumothorax appears to be far more prevalent. Both occur chiefly in young men. In 186 cases of spontaneous pneumothorax reviewed, a history of exertion was present in less than one third.

In the 42 cases of spontaneous mediastinal emphysema recorded, chest pain was the chief complaint, associated with dyspnea in 29 cases. The most distinctive clinical sign is a peculiar sound heard over the heart, which has been described as a "crunching, crackling, clicking or bubbling or churning noise" synchronous with the heart beat. Diminution or obliteration of cardiac dullness upon percussion was reported in about one-third of the cases. Subcutaneous emphysema of the neck or outer chest wall, conclusive evidence of mediastinal emphysema, was detected in only about 25 per cent.

The signs of spontaneous pneumothorax may be summarized as follows: respiratory lag on the affected side; slight increase in resonance over the affected area; diminished to absent breath sounds and vocal or tactile fremitus and, possibly, displacement of the mediastinum away from the affected side.

Air within the mediastinum has been demonstrated roentgenographically in 38 per cent of the reported cases of spontaneous mediastinal emphysema. In the anteroposterior view the characteristic finding is a thin line of density parallel to the border of the heart, usually the left border. Lateral views may show air pocketed between the anterior border of the heart and the chest wall. Oblique views are valuable in revealing air in the posterior mediastinum. All three views should be taken in cases of suspected mediastinal emphysema.

A review of the cases of spontaneous mediastinal emphysema shows that in 23 cases (55 per cent), left pneumothorax was present upon x-ray examination. Although usually small and confined to the apical portion, the area of pneumothorax may be large, causing 40 to 75 per cent collapse of the affected lung.

The outstanding roentgen finding in spontaneous pneumothorax is, of course, presence of air in the pleural cavity. It is emphasized that air may be missed in mild cases unless a film is taken at expiration. Rarely will a lateral film show pneumothorax in those patients in whom the collapsed lung is plastered against the posterior wall of the pleural cavity. Fluoroscopy alone is not a reliable method of demonstrating pneumothorax. Atelectasis is always present to some degree, usually involving the upper lobe of the affected lung. A small amount of fluid is observed in the costophrenic sinus in about one-half of the patients with spontaneous pneumothorax. Any measurable quantity of fluid should arouse strong suspicions of tuberculosis or, much more rarely, of hemopneumothorax. Adhesions are rarely observed in spontaneous pneumothorax and their presence suggests the possibility of tuberculosis.

Therapy is principally supportive, although aspiration of trapped air may be indicated in severe cases. While recurrences are common, the prognosis in uncomplicated cases is uniformly good.

Two tables.

Question of Cardiac Hypertrophy in Residents of High Altitudes. Gonzalo Esguerra Gomez. J. A. M. A. **137:** 1297–1301, Aug. 7, 1948.

The city of Bogota, capital of Colombia, is 8,016 feet above sea level. Since conflicting conclusions had been announced regarding cardiac hypertrophy and increased heart size at this altitude, a study was made of 480 normal inhabitants of the city. A teleroentgenogram of the chest was taken at 6 feet and the transverse diameter of the heart correlated with the height and weight according to the method of Ungerleider and Clark. The resulting distribution of figures was exactly the same as that of Ungerleider and Clark. The findings withstood various statistical tests. Electrocardiograms were also normal. Residence in Bogota, therefore, is believed not to contribute to enlargement of the heart.

Three charts. PAUL W. ROMAN, M.D.
Baltimore, Md.

Hoarseness in Heart Disease. J. Lawn Thompson, Jr. and Albert D. Kistin. Ann. Int. Med. **29:** 259–273, August 1948.

Late recurrent laryngeal nerve palsy in association with the heart disease is apparently very uncommon. It has been reported in mitral stenosis, coronary arteriosclerotic heart disease with congestive failure, and congenital heart disease with pulmonary artery dilatation. From a review of the cases in the literature, it is apparent that dilatation of the pulmonary artery is the prime cause of the nerve injury. Other common cardiovascular abnormalities causing left recurrent laryngeal nerve palsy (manifested by hoarseness) are aneurysm of the arch of the aorta and aneurysm of the innominate or subclavian arteries. Two cases of rheumatic heart disease are recorded here, in which the only complaint at time of hospitalization was hoarseness. In one autopsy findings and in the other angiocardiographic studies furnished evidence favoring the conception that pulmonary artery dilatation is the major mechanism in the compression and subsequent degeneration of the left recurrent laryngeal nerve.

The authors do not believe that the association of left laryngeal nerve paralysis and heart disease is purely coincidental, as has been suggested by some. Opposed to such a view is the fact that the incidence of mitral stenosis is ten times as great in cases of recurrent laryngeal paralysis as in the general hospital population and also that in cases of rheumatic disease it has been found to be invariably the left nerve that is affected. It thus appears that the paralysis is in some way a direct result of the heart disease. The exact pathogenesis, however, is in doubt. Some writers believe that enlargement of the left atrium is a factor, and this was present to some degree in both of the authors' cases. Laryngeal nerve paralysis has been observed, however, in the absence of any significant left atrial enlargement, which would tend to minimize the importance of this factor.

Another point which is difficult of explanation is the frequency of pulmonary artery dilatation and the infrequency of left laryngeal nerve paralysis. It is possible that there is individual variation in susceptibility of the nerve to pressure and that in most instances it withstands pressure from a dilated pulmonary artery without functional derangement.

Three roentgenograms; 3 photomicrographs; 2 photographs. STEPHEN N. TAGER, M.D.
Danville, Ill.

Congenital Heart Disease. A. Rae Gilchrist. Edinburgh M. J. **55:** 385–399, July 1948.

An outline is given of the disturbed circulatory dynamics of the more common congenital malformations. On this are based the radiologic pattern, the physical findings, and a rational therapy. The different types of congenital heart disease are illustrated by excellent roentgenograms and diagrams showing the circulatory disturbance in each instance. So many articles have appeared in the literature recently on this subject that space will not be devoted to a detailed abstract.

Fourteen roentgenograms; 7 diagrams; 2 photographs.

Double Aortic Arch: Report of Two Cases. Willis J. Potts, Stanley Gibson, and Robert Rothwell. Arch. Surg. **57:** 227–233, August 1948.

Double aortic arch presents a characteristic clinical picture of laryngeal stridor and difficult respiration shortly after birth. The symptoms may be intermittent or may vary with the position of the infant. Asthma-like wheezing, cyanosis, suprasternal retraction, and attacks of unconsciousness are common. Respiratory infections are frequent. As the child becomes older, a chronic non-productive cough, like the bark of a sea lion, is characteristic. Dysphagia is the rule, and regurgitation leads to attacks of coughing. The symptoms closely resemble those of thymic enlargement, and x-ray therapy is often given these patients on such a diagnosis.

Fluoroscopic and radiographic examination shows a characteristic picture. On contrast study the esophagus presents a concave defect on the posterior aspect at the level of the aortic arch. Bronchographic or bronchoscopic examination demonstrates a depression of the trachea just above the carina.

The anomaly is due to persistence of the right aortic arch from the embryonic stage, and is characterized by a splitting of the aorta into two branches, which encircle the trachea and esophagus, beyond which they reunite. The anterior limb is usually the smaller and may be vestigial, but in one of the authors' cases the reverse was true, so that the insufficient exploration led to failure to correct the defect, with subsequent death of the child. Surgical division of the anterior limb in a second case led to a good result.

One roentgenogram; 4 drawings.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Erosion of Ribs in Coarctation of the Aorta. A Note on the History of a Pathognomic Sign. William Dock. Brit. Heart J. **10:** 148–149, July 1948. **Coarctation of the Aorta. Review of Twenty-Three Service Cases.** Maurice Newman. Ibid, pp. 150–157.

In the first paper, a very short one, Dock points out that the priority of discovery of rib notching in coarctation of the aorta belongs to Meckel, who published his work in 1827. An interesting point in this connection is that on the drawings published with the original paper the notches were shown on the upper instead of the lower border of the ribs. It is believed that the artist was responsible for the mistake.

The second paper is an analysis of 23 cases of coarctation discovered in men with war records (20 from World War II, 3 from World War I) while in service or upon discharge. One case was diagnosed at autopsy after a dissecting aneurysm had ruptured into the pericardium. This patient had had no symptoms or signs of cardiac disability, having been passed twice for overseas duty. He was twenty-nine years old at death, which occurred during a period of leave. A second death occurred during operation for the coarctation; a third patient died of subacute bacterial endocarditis.

Of the 3 patients who served in the first World War, 1 was dead but had lived to the age of sixty-eight. In the last four years of life he had attacks of fainting because of heart block. The other 2 men were still living, but with symptoms of heart failure, one at forty-six and the other at fifty-four years of age.

Radiologically the most constant signs of coarctation were erosion of the ribs and absence or smallness of the aortic knob. In the 22 cases for which roentgenograms were available, 4 failed to show any erosion; 1 showed erosion of one clavicle but no rib involvement. In only 2 of the series was the aortic knob of normal size. Cardiac enlargement was demonstrable radiologically in 16 cases of the series, but the degree of enlargement had no relation to the height of the blood pressure.

The long lives in the World War I cases and the few deaths in the World War II cases (though 5 patients were over thirty when the diagnosis was made) would tend to give this condition a more favorable prognosis than it has had in the past.

Three tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Visualization of Patent Ductus Arteriosus Botalli by Means of Thoracic Aortography. G. Jönsson, B. Brodén, H. E. Hanson, and J. Karnell. Acta radiol. **30:** 81–90, Aug. 31, 1948.

After a brief discussion of the methods of angiocardiography and aortography used by other workers, the authors present their own method—a modification of Radner's (Acta radiol. **29:** 178, 1948. Abst. in Radiology **52:** 139, 1949)—in which the radial artery is catheterized and the dye injected into the aorta. Three case reports are presented.

The first patient was a 26-year-old female with typical clinical symptoms of patent ductus and slowly failing heart. The catheter was introduced into the anterior sinus of Valsalva and 50 c.c. of 70 per cent diodrast was injected. Good visualization of the patent ductus was obtained. It was 9 mm. in diameter and 4 to 5 mm. long.

The second case was that of a 47-year-old male with a history of rheumatic infection in childhood. The patient was found to have an enlarged, failing heart with a systolic and diastolic murmur rather than a true continuous murmur. Blood gas analysis by heart catheterization indicated a considerable admixture of venous and arterial blood. Aortography revealed a large patent ductus proceeding to the left branch of the pulmonary artery.

The third case was that of a white male of 26 years who had a strong continuous thrill and murmur in the second left intercostal space with some predominance of the systolic component. Heart catheterization revealed excessive oxygen saturation of the pulmonary artery blood with an insignificant increase in mean pressure. Aortography showed only a slightly increased opacity of the aorta following injection of the dye 5 cm. above the semilunar valves. The aortographic diagnosis was interarterial communication possibly located near the base of the heart, but the surgical diagnosis was a probable ruptured aneurysm of the sinus of Valsalva. A patent ductus was not found.

The outstanding points in aortography of patent ductus arteriosus as demonstrated by the authors' cases are (1) good visualization of the pulmonary artery, especially the left main branch, and (2) visualization of the communication between the two vessels, although this last is not as clear as could be wished.

Reproduction of films is excellent, although in the positive.

Five roentgenograms.

G. REGNIER, M.D.
University of Arkansas

Heart Block in Osteitis Deformans. C. V. Harrison and Bernard Lennox. Brit. Heart J. **10:** 167–176, July 1948.

After seeing 2 cases of Paget's disease (osteitis deformans) with extensive calcification of the heart valves and rings which apparently caused complete heart block, the authors reviewed their records and the literature for similar cases. They found 13 cases of generalized Paget's disease in their departmental records and 30 autopsied cases in the literature in which the heart was described or could reasonably be assumed to be normal. In 6 of the former group and 11 of the latter valvular calcification was present—that is, in 17 of 43 cases. This incidence—39 per cent—was found to be five times that in a control series of 223 autopsies of similar age distribution.

The authors believe that the increased incidence of calcification of the heart valves in osteitis deformans is attributable to the unduly labile calcium metabolism in that disease. The deposit of calcium in the collagenous tissue interferes with the conduction mechanism at the junction of the auricles and ventricles, producing the block.

Three roentgenograms; 2 electrocardiograms; 3 photomicrographs; 2 tables; 1 chart.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

THE DIGESTIVE SYSTEM

Megaesophagus Detected Radiologically without Opaque Contrast Media. Even and Barré. J. franç de méd. et chir. thorac. **2:** 467–469, 1948. (In French)

The presence of a widely dilated esophagus gives a typical and characteristic shadow on chest roentgenograms which can and should be recognized even before barium studies are made. The shadow consists of a homogeneous semi-opacity coursing down the length of the mediastinum and occupying the posterior right aspect of the chest. The ingestion of barium of course gives the final proof.

Six roentgenograms. E. M. SAVIGNAC, M.D.
Detroit, Mich.

Traction Diverticulum at the Esophageal Mouth and Spondylosis Deformans of the Cervical Spine. Umberto Cocchi. Radiol. clin. **17:** 199–206, July 1948. (In German)

This report is concerned with two cases in which traction diverticula just above the upper esophageal orifice were associated with spondylosis deformans of the cervical vertebrae. So far as the author could discover, they are the first such cases reported. The diverticula were symptomless. They are permanent protrusions and are not to be confused with temporary protrusions from the lumen, or pseudo-diverticula.

In order to verify any relationship between the spondylosis and the diverticula, a review of all cases of esophageal diverticulum in the author's files was made, as well as of 377 patients with miscellaneous conditions whose necks were studied incidentally. Spondylosis was found in 87.5 per cent ± 8.64 per cent of those with diverticula and in 78.9 per cent ± 9.36 per cent of a small group with normal esophaguses. Of the control group of patients, 78.4 per cent ± 5.1 per cent showed spondylosis. These differences are not statistically significant, and the conclusion of the author is that no positive statement can be made on this point.

Two roentgenograms; 1 table.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Congenital Varices of the Esophagus. Sigvard Jorup. Acta paediat. **35:** 247–257, 1948.

A case of varices of the esophagus is reported. The patient, first seen at the age of six months, had had attacks of vomiting since birth; sometimes the vomitus was streaked with light red blood. As the child grew older, vomiting became less and less, with increasingly long periods between attacks of hematemesis. The liver and spleen were never enlarged, and the blood pattern, except for slight anemia, was normal. Roentgen examination of the esophagus when the patient was three years of age revealed winding, tortuous vessels, with large, irregular, rarefied sections and a remarkably wide lumen. Fluoroscopy showed retarded evacuation.

Nothing was found to account for the varices. There was no evidence of infection of the navel, which might be the cause of vascular changes in the portal vein. Nor were there changes in the spleen, liver, or blood vessels such as are sometimes associated with infections like erysipelas, whooping cough, diphtheria, etc. The Widal test was negative. There was nothing to suggest angioma on roentgen examination of the rest of the alimentary tract. It is concluded, therefore, that the condition was congenital.

Splenectomy has sometimes been performed to relieve the portal system but did not seem indicated in the present case, in which the symptoms were moderate and the risk of severe bleeding slight.

Two roentgenograms.

Roentgen Signs of Esophageal and Gastric Injury from Corrosive Poisons. Iván Rodé. Acta radiol. **30:** 105–128, Aug. 31, 1948. (In German)

The effects of ingestion of alkaline poisons are usually more dangerous and severe and more widespread in the gastro-intestinal tract than are those of acid poisons. Usually both the esophagus and the stomach are involved. However, it may often happen that only the esophagus is affected.

With acid poisons, the esophagus is commonly not involved and the damage is confined to the stomach. It is also more common for an isolated pyloric scar to be caused by acids than by alkalis. The pyloric scars are due to the lowered tone of the stomach and the altered viscosity of its contents. After ingestion of an acid poison, the mucosal pattern of the stomach may show a "honeycomb" appearance.

The duodenum is seldom involved in the case of acid poisoning, and the author has seen lesions here only after alkali poisoning.

It is not possible to differentiate between the scars due to acid or alkali poisoning and those due to other causes, by roentgenological methods.

Twenty roentgenograms.

Pyloric Stenosis Caused by Ingestion of Corrosive Substances: Report of a Case. Howard K. Gray and Chester L. Holmes. S. Clin. North America **28:** 1041–1056, August 1948.

The authors present a rather complete review of the literature on the incidence of pyloric stenosis due to corrosive agents. Hydrochloric acid is most commonly reported to cause pyloric stenosis. Sulfuric acid, though more frequently ingested, may not permit survival long enough for stenosis to occur.

The majority of patients ingesting acids show little damage to the esophagus, or only a superficial effect. The converse is true of caustics, such as potassium hydroxide. In these latter cases, the principal damage is in the mouth and esophagus, because of the immediate deep coagulating effect upon all tissue, and because of the fact that when the alkali reaches the stomach it is partially neutralized by the gastric contents.

If the patient survives and if pyloric stenosis develops, anorexia, nausea, vomiting of food particles, dehydration, and alkalosis become the major symptoms. The stenosis may develop in a few weeks to six years, as reported in one case. Roentgen examination usually confirms the diagnosis, but without a positive history carcinoma may be suspected in some cases.

The only treatment is surgical. The specific type of surgery is an individual problem with each patient and each surgeon.

One case is recorded, in a 33-year-old male with pyloric stenosis occurring one month after ingestion of

1-1/2 ounces of sulfuric acid by mistake. Roentgen examination of the stomach disclosed dilatation, complete obstruction of the outlet, and a large amount of retained secretion. A partial gastrectomy was successfully performed.

Four illustrations, including 1 roentgenogram.

JOE B. SCRUGGS, JR., M.D.
University of Arkansas

Form Changes of the Stomach (Cascade Stomach, Volvulus of the Stomach). Orhan Toygar. Schweiz. med. Wchnschr. **78:** 767–772, Aug. 7, 1948. (In German)

Cascade stomach and volvulus of the stomach are considered to be different stages of the same process, or at least to be produced by the same factors. Contrary to statements in the literature, cascade stomach is not produced by aerophagia, and experiments proving this are described. Gaseous distention of the colon, enlargement of the spleen, intra-abdominal tumors, pregnancy, and congenital shortening of the lesser omentum may produce this condition by elevating the greater curvature. Löw-Beer reported a case (Röntgenpraxis **4:** 377, 1932) in which volvulus of the stomach was associated with duodenal diverticulum. In almost every case, cascade stomach develops in the steerhorn type of stomach, since a "drop" stomach can scarcely be forced into the cascade configuration. Symptoms are vague and not characteristic in cascade stomach, but a typical finding is relief when the patient lies on the right side, especially from symptoms occurring after eating. Volvulus, on the other hand, leads to a grave picture, with poorly defined epigastric pain, retching or vomiting, and signs of collapse. This rather rare condition may be of two types; the "organo-axial," in which torsion is along the long axis of the stomach, or the "mesenterio-axial," with torsion across the short axis; the former is found in about four-fifths of cases. To the characteristic triad of non-productive vomiting, indefinite epigastric distress, and inability to pass a sound through the cardia, the author proposes to add a fourth sign, failure of contrast medium to pass the cardia at fluoroscopy.

The treatment of cascade stomach is primarily conservative; manual reposition of the stomach may be possible, and the author describes the procedure in detail. Surgery is contemplated only when medical management fails, or in the presence of some other indication for operation.

Nine roentgenograms; 4 drawings.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Acute Volvulus of the Stomach with Spontaneous Reduction. Carl A. W. Zimmermann, III. J. Missouri M. A. **45:** 585–592, August 1948.

A case of acute volvulus of the stomach of the anterior, organo-axial type, in which spontaneous reduction occurred after about four weeks, is reported. An associated ectopic pregnancy in this case was considered coincidental.

An endeavor was made to explain the mechanics of gastric volvulus by studies on a cadaver. The two axes of anterior organo-axial volvulus of the stomach appear to be: (*a*) the fixed portion of the duodenum and (*b*) the gastrosplenic ligament.

The length of the gastrocolic ligament is considered of little importance. If it is normal or short, the transverse colon simply follows the stomach, or the gas-filled transverse colon displaces the greater curvature upward. The volvulus would seem less likely to occur with a long ligament.

Attention is called to the fact that, by reason of the high and rotated position of the pyloric end of the stomach, the duodenum makes a wide curve which is not unlike that formed around the head of a pancreas involved in a tumor.

Six roentgenograms.

Tumors of the Gastric Fundus. Carlos Bonorino Udaondo and Victorino D'Alotto. Prensa méd. argent. **35:** 1378–1382, July 16, 1948. (In Spanish)

The authors, who are associated with the National Institute of Gastroenterology in Buenos Aires, note that tumors of the fundus of the stomach are the most silent and dangerous of all gastric neoplasms. They are especially difficult of recognition because of their inaccessibility to ordinary clinical exploratory procedures and their insidious symptoms. They constituted 7.5 per cent of 600 cases of cancer of the stomach studied at the National Institute.

Because of their silent character these tumors are usually of large size before they are discovered. Outstanding symptoms are dyspeptic phenomena, excessive loss of weight, and hypochromic anemia. In some cases gastric hemorrhage is the only symptom. Epigastric pain is usually present, but is not of itself characteristic. It may be relieved or aggravated by food. Radiation to the left side posteriorly was observed by the authors in only 3 out of 46 cases. Dysphagia is the usual complaint, with alternations between acute functional obstruction and periods of almost normal function. Regurgitation and sialorrhea are inconstant symptoms.

Gastroscopy is usually difficult in these cases, and even dangerous. It was attempted in the majority of the cases seen by the authors, but the results were usually negative. In 50 per cent of the cases it was not possible to pass the cardia. Roentgenography is the procedure of greatest importance in the diagnosis of fundal gastric tumors, but adequate technic is essential. This is described at some length by the authors. They lay stress upon air or gas inflation, the tumor often being set forth by contrast in the air-filled fundus when the patient is in the erect position.

JAMES T. CASE, M.D.
Chicago, Ill.

Diverticulum of the Duodenum. Report of a Case. Angel I. Reyes and Victor T. Nañagas. J. Philippine M. A. **24:** 369–371, July 1948.

A case of duodenal diverticulum diagnosed roentgenographically and confirmed at operation is reported. The original impression was that the patient had a peptic ulcer, and three gastro-intestinal series were performed before the final diagnosis of diverticulum arising from the second portion of the duodenum was established.

Hematoma of the Jejunum with Subileus. Kjell Liverud. Acta radiol. **30:** 163–168, Aug. 31, 1948.

A hematoma in the intestinal wall is one of the rarest causes of ileus. The hemorrhage is usually subserous or submucous and may obstruct the bowel lumen directly or by producing an invagination. The condition may or may not be related to an increased tendency to hemor-

rhage, as in hemophilia. Cases have been reported following hernia operations and one after intraperitoneal injection of fluid.

A proved case with x-ray findings is reported, in which a mass with a smooth surface and of soft consistency was demonstrated and thought to be a lipoma, cyst, or adenomyoma. At operation, the jejunum for a length of 10 cm. was found to be blue-black in color and spindle-shaped. On manipulation, the blackened serosa ruptured, a mass of black coagula and old blood escaped, and the bowel contracted to almost normal caliber. For safety's sake a gastro-enterostomy was done.

It was later found that the patient, a boy of three, had been kicked in the stomach.

This case demonstrates the usefulness of the roentgen examination in obscure abdominal ileus, especially high ileus.

Four roentgenograms.

C. S. POOL, M.D.
University of Arkansas

Volvulus of the Cecum. Claude F. Dixon and Alfred C. Meyer. S. Clin. North America **28:** 953–963, August 1948.

Urgent problems of intestinal obstruction are presented by volvulus of the cecum. The diagnosis is infrequently made, the mortality rate is appallingly high, and the condition is not too often considered in the differential diagnosis. The authors report a series of 12 cases.

Any degree of incomplete rotation of the cecum, such as might result from a long mesentery which would allow the right portion of the colon to be displaced to the left side, furnishes the potential for a volvulus. The exciting cause may be anything that distorts an already mobile cecum.

Signs and symptoms are those of a low intestinal obstruction, but absence of vomiting and passage of gas or fecal material by rectum should not obscure the early diagnosis. The classic picture of abdominal distention accompanied by colicky pain was observed by the authors in all their cases of acute volvulus. Occasionally diagnosis may be made roentgenographically. A hugely distended loop of bowel is apparent, and the presence of gas in the small intestine is evident, but the colon is not distended.

In the absence of gangrene, simple detorsion and fixation, if possible, is the best method of handling the cases surgically. If gangrene is present, resection over a three-bladed clamp is the safest procedure. A new operative procedure is suggested for correction of intermittent volvulus of the cecum.

Four roentgenograms; 2 drawings.

C. S. POOL, M.D.
University of Arkansas

Diagnostic and Therapeutic Problems in Diverticulitis. C. P. LeRoyer, Jr. and Benjamin V. White. New England J. Med. **239:** 245–249, Aug. 12, 1948.

Inflammatory change, or diverticulitis, occurs in 17 to 20 per cent of all cases of diverticulosis. This study is based upon 200 cases of diverticulitis seen between 1927 and 1946. The patient is usually over forty-five years of age with a history of spastic constipation or diarrhea. Chills and fever, lower abdominal cramps and soreness, and recent change in bowel habits are frequent complaints. The white cell count is often over 11,000. Spasm and diverticula are usually demonstrated by barium enema studies. Sigmoidoscopic examination is seldom useful.

In this series, diagnosis was made by clinical and x-ray findings in 161 cases, at operation in 32, from the clinical picture alone in 5, and at autopsy in 2. In 15 of the cases diagnosed at operation, appendicitis had been suspected; preoperative diagnoses in the remaining 17 included pelvic inflammatory disease, acute cholecystitis, intestinal obstruction, and ruptured ovarian cyst. In none of these was a barium enema study performed.

The authors have found two leading symptoms that are seldom discussed, namely low back pain and melena. Low back pain was found in 20 per cent of their cases and is attributed to irritation of the mucosa of the sigmoid. This radiation of pain to the lower back is found also in mucous colitis and ulcerative colitis. Blood in the stool occurred in about 16 per cent of the patients and usually consisted of small flakes. On occasion, however, massive hemorrhage may occur from rupture of a diverticulum into a large blood vessel.

In 133 cases of diverticula in which a barium enema was given, the sigmoid showed definite spasm, with narrowing of the lumen. In 33 of these patients, a mass was also demonstrable, invariably in the sigmoid region.

In the differential diagnosis, appendicitis, carcinoma of the sigmoid, and masses in the genito-urinary tract must be considered. Acute appendicitis is more likely to be confused with acute diverticulitis when the sigmoid colon extends to the right of the midline. Carcinoma of the sigmoid coexists with diverticulosis of the sigmoid in about 3 per cent of the patients. Differentiation of carcinoma and diverticulitis is difficult and occasionally impossible.

Some cases of diverticulitis present primary urinary tract symptoms consisting of dysuria, frequency, and burning on urination. In these patients, it is usually found that the diverticula or their complicating abscesses involve the bladder or adjacent structures.

Perforation of a diverticulum may lead to localized abscess, peritonitis, mechanical obstruction, or fistula formation.

One roentgenogram; 1 drawing; 4 tables.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Internal Hernia with Strangulation of Bowel Due to a Defect in the Falciform Ligament. Joseph Gaster. Ann. Surg. **128:** 248–252, August 1948.

To the standard classification of internal hernias the author adds another, namely, hernia through defects in the falciform ligament. Two cases are recorded. A roentgenogram from one of these is reproduced. This shows a gas shadow in a closed loop of small intestine under the right diaphragm, which should have led to a preoperative diagnosis had the possibility of this unusual condition been realized.

Further Clinical Observations on the Use of Dibutoline, a New Antispasmodic Drug. G. H. Marquardt, J. T. Case, G. M. Cummins, Jr., and M. I. Grossman. Am. J. M. Sc. **216:** 203–211, August 1948.

Dibutoline (dibutyl urethane of dimethyl ethyl-β-hydroxy ethyl ammonium sulfate, Merck) exerts a direct inhibitory effect on smooth muscle of the intestine as well as an atropine-like action. In the normal

stomach it inhibits motor activity and causes a transient suppression of gastric secretion. It has a more rapid, more intense, but much shorter action than atropine. The side effects are mild dryness of the mouth and diminished ocular accommodation. The adult dose is 10 mg. given parenterally only.

The clinical effect of dibutoline was studied in the gastro-intestinal tract, the biliary tract, the urinary system, and the uterus. It is felt that the drug is of real value in colonic spasm, chronic ulcerative colitis, pylorospasm associated with duodenal ulcer, and peptic ulcer pain. It proved useful also in combating spasm of the upper gastro-intestinal tract and of the colon during the course of x-ray examination.

Five roentgenograms; 1 chart.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Calcified Echinococcosis of the Liver with Thoraco-Abdominal Symptoms. M. Ben Ami. Radiol. clin. **17:** 193–199, July 1948. (In French)

A calcification in the right upper quadrant of the abdomen was at first thought to be a gallstone, but following cholecystography with normal findings a diagnosis of echinococcus cyst was made. Biologic tests were negative, but pathologic examination following operation confirmed the x-ray diagnosis. The dyspnea and abdominal pain experienced by the patient are explained by the location of the cyst near the posterior costophrenic sulcus, a stimulation of the vagus nerve being postulated.

One roentgenogram. LEWIS G. JACOBS, M.D.
Oakland, Calif.

Correlation Between the Cholecystogram and the Secretin Test for Gall Bladder Function. W. J. Snape, M. H. F. Friedman, and P. C. Swenson. Am. J. M. Sc. **216:** 188–194, August 1948.

The secretin test for gallbladder function is based on the fact that secretin stimulates the flow of both liver bile and of pancreatic juice. In a normal person who has received secretin, the increased liver bile is taken up by the gallbladder and concentrated. Therefore, the duodenal content will contain mostly pancreatic juice and small amounts of bile. However, in patients without a gallbladder or with a non-functioning gallbladder, the bile flows directly into the duodenum and the duodenal content will be high in bile. In the presence of obstruction of the bile ducts, there will be no bile in the duodenum. With liver damage, there will be a normal amount of bile in the duodenal content unless the hepatic lesion is severe enough to prevent secretion of bile, in which case none will be found in the duodenum.

The authors carried out the secretin test on 64 patients. The subjects in whom the tests were to be made fasted overnight. The next morning a double lumen tube was introduced into the stomach and duodenum, under fluoroscopic guidance. The gastric and duodenal contents were aspirated separately for a basal control period of twenty to thirty minutes. Secretin was then given intravenously and constant aspiration continued for the next sixty minutes, samples taken at intervals being tested for bile. Cholecystograms of these patients were made in the usual manner, with Priodax.

In 55 of those examined the conclusions drawn from the two tests were the same. In cases where the results were at odds, the authors felt that the secretin test was a more sensitive indicator of non-function of the gallbladder. On the other hand, the presence of stones was shown only by the radiologic study.

The secretin test is not suggested as a substitute for the much simpler x-ray examination, but is recommended as a useful supplement when the data from the cholecystogram are difficult to interpret.

One chart; 1 table. PAUL W. ROMAN, M.D.
Baltimore, Md.

Intravenous Cholecystography with Tetraiodophthalic Fluorescein. George E. Moore and Marcus J. Smith. Surgery **24:** 17–21, July 1948.

A new agent, tetraiodophthalic fluorescein, for intravenous cholecystography is described. It is an iodinated fluorescein, in which four iodine atoms are attached to the phthalic ring, and is 30 per cent soluble. In 22 examinations, this dye gave gallbladder visualization comparable to that obtained with tetraiodophenolphthalein. Toxic reactions were minor, consisting of transient nausea in two patients, with no instance of vomiting or diarrhea. In three patients, receiving large amounts (9 to 10 gm.) in the course of skull studies, acute thrombophlebitis developed at the site of injection. With amounts suitable for gallbladder visualization (2 to 3 gm.) this complication did not occur.

Simplicity of patient preparation and the short time interval (two to three hours) between injection and optimum visualization are considered possible advantages. The procedure was successfully used on two patients with pyloric obstruction, where oral dye was valueless.

Four roentgenograms; 1 table.

J. E. WHITELEATHER, M.D.
Memphis, Tenn.

A New Position for Cholecystography. B. R. Kirklin. Am. J. Roentgenol. **60:** 263–268, August 1948.

For cholecystography the author recommends a postero-anterior view with the patient in a right lateral decubitus position. This allows the gallbadder to gravitate toward the right side and away from loops of bowel in that region. All the advantages of the vertical position are obtained, as well as a better visualization of the bile ducts, less motion on the part of the patient, with consequent avoidance of blurring of the shadows, and more effective demonstration of layering of the bile.

The apparatus used is a plain table, a vertical Potter-Bucky diaphragm in conjunction with a cassette changer, and a standard tube stand.

This position is not meant to replace the standard prone position, which is most effective in revealing tumors, such as adenoma.

Eighteen roentgenograms; 1 photograph.

C. S. POOL, M.D.
University of Arkansas

Cholangiography in Stone, Stricture and Operative Injury of Biliary Ducts. C. R. Hughes, J. R. Hannan, and B. E. Mulvey. J. A. M. A. **137:** 687–690, June 19, 1948.

The authors review their experience with cholangiography in 90 consecutive patients who have had exploration of the common duct for stone, stricture, or stenosis. It has led them to the following conclusions: (1) Cholangiography is an accurate means of determin-

ing the presence or absence of disease in the biliary ducts. (2) Roentgen visualization of the biliary tree following the injection of an opaque medium is a simple diagnostic procedure. (3) More positive information can be obtained by cholangiography than by surgical exploration of the biliary ducts. (4) It is essential and advantageous to employ cholangiography at the time of operation. By this procedure, lesions not evident to the surgeon may be demonstrated and re-operation avoided. (5) Postoperative cholangiograms are necessary to confirm the absence of disease in the duct system before the T-tube is removed.

If the following conditions apply, it is believed that the ducts should be explored and hence cholangiography is indicated: (1) if the patient is jaundiced at the time of operation or if there is a history of jaundice in the past; (2) if multiple small stones are found in the gallbladder at operation; (3) if the ducts are dilated or obviously diseased; (4) if a stone in the duct is suspected on palpation; (5) if a small fibrotic gallbladder is discovered; (6) if bile aspirated from the duct is muddy; (7) if the liver is cirrhotic. Cholangiography is also indicated if there is any reason to suspect injury to the bile ducts during operation.

Since exploration of the common duct is practically always followed by T-tube drainage, delayed cholangiography should be repeated at intervals after the operation until the bile ducts have returned to a normal or postoperative physiologic state.

The authors use a rapid injection method in order to facilitate rapid filling of the ducts and radicles so that the relatively small opening through the ampulla does not permit rapid transit into the duodenum. They use 35 per cent iodopyracet.

Immediate cholangiography is not infallible in the presence of multiple small stones or gravel, especially when there is no duct obstruction.

Postoperative cholangiography was 93.3 per cent accurate in demonstrating common duct stones not found at previous surgical explorations. Cholangiography at the time of operation can lower the incidence of re-operation for stone or for ductal trauma and prevent stricture due to unrecognized operative trauma. Operative cholangiography in the presence of stricture, stenosis, or transection of the common duct may not be feasible. Delayed cholangiography in this group can demonstrate the patency of the newly constructed anastomosis. In all cases, postoperative cholangiography provides the best criteria for discontinuing T-tube drainage.

Six cholangiograms.

S. B. FEINBERG, M.D.
University of Michigan

Management of Residual Common Duct Stones. Duncan Shepard. J. M. A. Georgia **37:** 289–293, August 1948.

Cholangiography should be used routinely in all patients submitted to choledochostomy, as the surest method of determining the absence of residual common bile duct stones. For this purpose, hippuran or diodrast is to be preferred to the heavier media, 10 to 50 c.c. being used, depending on the amount of hydrohepatosis present. It is advantageous to take a film immediately on the completion of injection of the medium and at ten-minute intervals thereafter until fluoroscopy shows the dye entering the duodenum. Oblique as well as anteroposterior views are helpful in visualizing the common duct, especially in the retroduodenal portion. At times the dye may enter the duodenum so rapidly that the common duct is not well visualized. If this occurs, cholangiography should be repeated thirty minutes after the administration of morphine or some similarly acting drug.

If residual common duct stones are found, the more conservative non-surgical methods of removal, such as irrigation of the duct drain with solution G or the instillation of 1:500 nupercaine solution, should be tried. Irrigation with ethyl ether is painful, dangerous, and usually unsuccessful. Occasionally secondary choledochotomy and mechanical removal are necessary.

Seven cholangiograms.

THE DIAPHRAGM

Movement of the Diaphragm After Operation. John Howkins. Lancet **2:** 85–88, July 17, 1948.

A study was made of the diaphragm in 200 service men in good physical condition before and after an elective operation, such as herniorrhaphy, to discover the cause of the high incidence of postoperative chest complications. The material was standardized as far as possible, each case receiving the same preoperative medication. In 127 cases spinal anesthesia was employed to show that a non-inhalation anesthetic is no insurance against postoperative pulmonary complications. As a rule, no postoperative respiratory depressants were used. Twenty-four hours before operation, the patient's vital capacity, chest expansion, and movement of the diaphragm were measured, the latter under fluoroscopic control.

In the 200 cases the lower limit of normal excursion was 1.5 cm. and the upper 10 cm., with an average of 5 cm. In 158 patients there was a diminution of 1 cm. or more following operation. Of these, 31 had postoperative chest complications, while of 42 showing no diminution, 2 had chest complications. Of 83 with a diminution of 2 cm. or more, 24 had chest complications, and of 36 with a diminution of 3 cm., 16 had chest complications. This connection between diminished diaphragmatic movement and chest complications is explainable in two ways: (1) the diminution of diaphragm movement encourages atelectasis, which may or may not lead to an infective process and pneumonitis; (2) the atelectasis precedes the diaphragmatic changes, and is the cause and not the effect of these. It was observed that the radiologic evidence appears before the clinical signs. In some cases showing diminution of diaphragmatic excursion, chest complications were expected and did arise before there was actual clinical evidence of any lesion in the lung. In the 149 cases investigated, it was found that the diminution of movement was not confined to the side of the operative wound.

Vital capacity was reduced to some extent after most of the operations, the percentage reduction being least in the extra-abdominal and greatest in the hernia cases. Big reductions in vital capacity were observed in patients in whom postoperative lung complications developed.

Any patient who exhibited fever, cough, and sputum was considered to have a postoperative chest complication. Of 33 such cases, 11 showed radiologic changes not present preoperatively. The change most often observed was partial or complete atelectasis of the lower zones; apical changes were never observed in this series. In 4 cases pneumonic consolidation developed. Many of the patients had persistently clear lung fields.

The atelectasis rate of 5.5 per cent in this series agrees with the findings of other workers.

An attempt was made to reproduce radiographically the alteration in position of the diaphragm with change of posture and to measure this. Certain errors were inescapable. When the tube is centered on the level of the diaphragm in the mid-position between expiration and inspiration, the divergence of the x-rays is appreciable at full excursion, and this distortion can be overcome only by orthodiagraphic measures.

Seven roentgenograms are reproduced showing a rough and uncorrected picture of the true levels of the diaphragm, along with a table indicating the variations of diaphragm position with change of posture.

THE MUSCULOSKELETAL SYSTEM

"Hypophosphatasia": A New Developmental Anomaly. J. C. Rathbun. Am. J. Dis. Child. **75:** 822–831, June 1948.

The author reports what he believes to be the first account of faulty bone development associated with absence of alkaline serum phosphatase. The patient was a poorly nourished infant with deformities of the wrists and bowing of the legs. Only four rounded plaques of bone were palpable in the frontal and parietal regions of the skull; the vault was otherwise soft and felt like a balloon filled with water. There was beading at the costochondral junctions. The blood chemistry showed slightly elevated calcium and phosphorus. Except for a markedly diminished excretion of calcium and phosphorus, urinary findings were negative. Repeated determinations showed either a complete absence of alkaline serum phosphatase or an extremely low figure.

The roentgen findings were marked decalcification throughout the skeleton, deformities of the ribs, lack of normal calcium density at the metaphysial ends of the long bones. The epiphyses were unaffected. Fractures of the metaphyses of the radius and ulna were noted.

The histologic findings postmortem were most interesting. The kidneys showed the tubules distended with casts. It was shown that these casts did not contain calcium and certainly not calcium phosphate. This was significant in view of the low calcium and phosphorus excretion. The picture at the growing ends of the bones resembled that seen in rickets. The vault of the skull showed a normal framework of osteoid tissue but no deposition of calcium.

Samples of various tissues were found to be abnormally low in phosphatase. The basic premise was that this was a case of primary failure by the osteoblasts to produce alkaline phosphatase; that is, a mesenchymal differentiation defect.

Two roentgenograms; 2 photomicrographs; 1 photograph; 4 tables. PAUL W. ROMAN, M.D.
Baltimore, Md.

Osteopetrosis. William J. Cassidy, Francis C. Allman, and Gerald J. Keefe. Arch. Int. Med. **82:** 140–158, August 1948.

The presentation of a case of osteopetrosis, with complete laboratory and roentgen studies, is followed by a review of the literature and a discussion of the causation (with special attention to the possibility of a viroid origin, as demonstrated in birds), the differential diagnosis, the pathologic, histologic, and roentgenologic aspects, prognosis, and treatment. The roentgenographic picture varies with the severity of the disease. In the milder type, first discovered when the patient has attained adult age, there may be little more than uniform increases in the density of the bones of the base of the skull, the spine, and the pelvis. In the florid disease of early childhood, the entire skeleton may be involved and grossly disfigured. The role of the cartilaginous precursor of bone in the development of osteopetrosis is stressed.

Eight roentgenograms; 2 audiograms.

Hypertrophic Osteoarthropathy. Harold L. Temple and George Jaspin. Am. J. Roentgenol. **60:** 232–245, August 1948.

Subperiosteal bone formation is often seen in association with pulmonary changes, but has been observed also in diseases of the heart, blood, liver, and even carcinoma of the thymus. The shafts of the long bones are chiefly affected, especially the tibia, fibula, radius, and ulna. In advanced cases, the clavicle, spines of the scapula, and vertebrae may be involved, and there may be changes in the joints. In early cases thin layers of new bone formation are demonstrable just beneath the periosteum. Later, the picture is one of thickened bone surrounding the shaft with a thin hard cortex.

Some authors think that two factors are necessary for secondary osteoarthropathy to occur, namely, a toxemia from long-standing disease and circulatory disturbances resulting from either cardiac or pulmonary involvement. However, no definite etiologic agent has been established.

Often symptoms of joint pain and swelling may be due to secondary hypertrophic osteoarthropathy. In 8 of the 11 cases reported by the authors these constituted the first manifestation of the associated disease. In all but 2 of the 11 cases the primary lesion was in the lungs. The exceptions were a case of chronic myelogenous leukemia with generalized lymphadenopathy, possibly involving mediastinal nodes, and a case of non-tropical sprue.

Eighteen roentgenograms. C. S. POOL, M.D.
University of Arkansas

Pituitary Implications in Hypertrophic Pulmonary Osteoarthropathy. William Bloom. Ann. Int. Med. **29:** 361–370, August 1948.

The recent trend of thought regarding the etiology and pathogenesis of chronic hypertrophic osteoarthropathy has been in the direction of chemical or hormonal stimulation. Fried (Arch. Int. Med. **72:** 565, 1943) believed that the diffuse osteoarthropathy found in neoplasms of the lung is related to a pituitary factor and, to substantiate this hypothesis, he presented 3 cases in which hyperplasia of the eosinophilic cells of the pituitary gland was found at autopsy. A case reported by the present author tends to support Fried's view. The patient had carcinoma of the lung accompanied by progressive hypertrophic pulmonary osteoarthropathy with periosteal thickening and subperiosteal new bone formation. At autopsy metastatic carcinoma was found in the anterior lobe of the pituitary. It is suggested that the metastatic lesions acted as a stimulant to excessive secretion of pituitary hormone, giving rise to the osseous syndrome in much the same manner as acromegaly.

The author stresses the necessity of separating this condition from other conditions, such as clubbed fingers, which have been regarded as different stages of the

same entity but which probably represent distinct syndromes.

Seven illustrations, including 3 roentgenograms.

STEPHEN N. TAGER, M.D.
Danville, Ill.

Dyschondroplasia with Hemangiomatosis (Maffucci's Syndrome) and Teratoid Tumor of the Ovary. J. F. Kuzma and J. M. King. Arch. Path. **46:** 74–82, July 1948.

A case of dyschondroplasia associated with hemangioma (Maffucci's syndrome) is reported. This case presented threefold evidence of mesodermal dysplasia: multiple enchondroma or dyschondroplasia, multiple hemangioma, and a teratoid (mesodermal) tumor of the ovary. The family history was not significant. The patient gave a history of rickets at the age of five years, which, if correct, would support Virchow's contention that the development of enchondromatosis represents misplaced immature cartilaginous rests brought about by improper osseous development. There had been a rather rapid development of multiple enchondroma, suggesting defective mesoderm; whether this represented an anomaly of the vessels or a neoplasm has not been determined. In structure the tumors ranged from the usual cavernous hemangioma to a rather cellular angioblastic tumor.

Extensive roentgen examination revealed many radiolucent cystic areas throughout the skeleton. Films of the pituitary area showed an irregular expanded outline of the sella turcica, suggestive of a pituitary tumor.

The patient's left fourth finger was amputated because of serious deformity. Histologic examination of the bony tumor revealed a mixed myxomatous and hyaline cartilaginous substance; articular surfaces were intact.

A 1,900-gm. teratoid ovarian tumor was removed by laparotomy. This was classified histologically as mesonephroma or teratoma by the American Registry of Ovarian Tumors. Two years after the removal of the ovarian tumor examination revealed a non-tender, hard pelvic mass pressing on the rectum and fixing the vagina and uterus. Fever, abdominal pain, vomiting, and increase in size of the mass, with ascites, came on rather quickly. Roentgen therapy (14,716 r through various ports) produced no response. Irregular cystic areas developed in a number of the ribs and both shoulder girdles. A roentgenogram of the pituitary area showed an increase in the size of the sella turcica with destruction of the bony outline. On laparotomy for partial obstruction of the bowel, the peritoneal surfaces were found to be covered with numerous irregular nodules of various sizes, microscopic examination of one of which showed peculiar myxomatous ovarian stroma resembling mucinous carcinoma. The consensus of opinion was that it was a teratoid tumor. The patient died three years after removal of the ovarian tumor.

Two roentgenograms; 2 photographs; 3 photomicrographs.

Septicemia Complicated by Osteomyelitis in the Newborn. Report of Case. Vincent A. Spinelli. Arch. Pediat. **65:** 347–353, July 1948.

A case of septicemia in a newborn infant is presented, with development of multiple abscesses, acute osteomyelitis of the head of the right humerus, and pyarthrosis. The condition was successfully treated with penicillin locally and systemically, immobilization of the joint, and supportive measures.

In such cases the invasion of bone is by way of the blood stream. The earliest x-ray finding is an area of bone destruction in the metaphysis adjoining the epiphyseal line This is followed by elevation of the periosteum, and finally the break through into the joint cavity, with the formation of soft-tissue abscesses and pyarthrosis. Restoration of normal growth depends upon the extent of epiphyseal destruction.

Three roentgenograms.

WILLIAM H. SMITH, M.D.
University of Louisville

Bilateral Brodie's Abscess. Report of a Case. E. R. Riggall. New Orleans M. & S. J. **101:** 12–15, July 1948.

The author presents a case report of Brodie's abscess involving the distal end of each tibia in a 19-year-old boy. A review of the literature reveals no such case reported during the past five years. The two lesions were treated six months apart, since originally only one abscess was diagnosed. When the lesion in the opposite extremity became apparent, a review of the earlier films revealed that both were present on the first admission. The diagnosis was confirmed pathologically. Treatment consisted in curettement of the cavities and open packing wtih vaseline gauze, with penicillin preoperatively and postoperatively.

Brodie's abscess is most frequently found in the proximal end of the tibia, approximately 75 per cent of the cases involving this bone. The majority of the patients are between eleven and thirty years of age and the male-female ratio is 2:1. A short summary of the differential diagnosis between Brodie's abscess and bone cysts, chronic sclerosing osteitis, sarcoma, gumma, endothelial myeloma, and tuberculosis is given.

One roentgenogram.

WYNTON H. CARROLL, M.D.
The Henry Ford Hospital

Uric Arthritis (A Casuistic Contribution). A. Bernstein and C. Buetti. Radiol. clin. **17:** 177–185, July 1948. (In German)

The authors report a case of gout in which an extremely high level of uric acid in the blood was observed, reaching 17.59 mg. per cent on one occasion. Bone and joint changes in the hands, feet, knees, and left sacroiliac joint were of extreme degree. Uric acid was demonstrated in material obtained from an ulcerated tophus on the big toe.

Seven roentgenograms; 1 photograph.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Eosinophilic Granuloma of the Bone. Report of Three Cases. Paul W. Lapidus, Lawrence B. Slobody, Godfred Germansky, and Milton M. Willner. Am. J. Dis. Child. **75:** 900–909, June 1948.

Three cases of eosinophilic granuloma of bone are added to the literature. In 2 cases only one bone was involved; in the remaining case there was involvement of two bones.

The first patient showed an irregular area of bone absorption in the upper end of the right humerus, bone expansion, periosteal reaction, and pathological fracture. At operation a soft fibrous yellow-brown tissue was curetted from the bone marrow. Bone chips from

the tibia were placed in the cavity. Microscopic examination showed the picture of eosinophilic granuloma. Roentgenograms made eight months later showed almost complete repair.

In the second case there was a tender mass over the manubrium sterni, which in roentgenograms was associated with a large cavity in the body of the first sternal segment. Curettage revealed eosinophilic granuloma. Recovery was uneventful but the mass recurred five months later in association with enlarged suprasternal lymph nodes. There was also an ovoid area of destruction in the upper end of the right humerus, which was asymptomatic.

The third patient was a 15-year-old boy who had pain in the right hip, with a limp. Roentgenograms showed a well circumscribed cystic area about 2.5 cm. in diameter above the right acetabulum. At operation this was seen to be filled with a gray granulation-like tissue. The cavity was curetted and filled with bone chips. The material removed was typical of eosinophilic granuloma. Three months later the cavity was obviously healing.

Eight roentgenograms; 2 photographs; 1 photomicrograph.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Roentgenographic Appearance of Renal Cancer Metastasis in Bone. Robert S. Sherman and T. Arthur Pearson. Cancer **1:** 276–285, July 1948.

Thirty-six proved cases of bone metastasis from cancer of the kidney were studied roentgenographically. Pain was the oustanding complaint in 32 cases. In 21 cases localized swelling was present. Four patients had pulsating tumors. Ten patients had previously been operated upon for renal cancer.

In 13 cases the clinical diagnosis was primary bone tumor and 14 cases were diagnosed as metastatic; in some the diagnosis was established before admission, and in others no clinical diagnosis was offered. Eighteen cases were diagnosed roentgenologically as metastatic. An additional 4 were described simply as "bone destruction" while some were called "malignant tumor." There were 4 cases in which the roentgen diagnosis was osteogenic sarcoma. In no instance was the diagnosis of renal cancer metastasis made on the basis of the roentgenographic appearance alone.

In 21 of the 36 cases, only a single metastasis was revealed in the roentgenogram. There was no significant site of predilection. In 15 cases the metastatic lesion was in a long bone (3 were in the mid-shaft, 10 toward the ends, and 2 at the ends, *i.e.*, in the former epiphyseal areas).

This study indicated that metastases in bone from renal cancer show practically constant features of medullary origin, oval configuration, destruction of medullary and cortical bone, and the formation of a periosseous mass. In no instance did production exceed destruction in degree. When occurring in tubular bones, the position of the metastasis was always symmetrical or nearly so. Pathological fractures occurred in about half the cases. A periosteal reaction was infrequent. The growth rate seemed to vary considerably, and most metastases showed little or no effect roentgenologically following moderate amounts of roentgen irradiation.

The authors divide bone metastases from renal cancer into three roentgenographic types: the lytic, the septate, and the patchy. The lytic was the most common, being found in 27 cases; the septate, in 6; and the patchy, in 3. The lytic form is characterized by a predominance of medullary and cortical destruction over productive change; the septate, by approximately equal degrees of production and destruction, with an internal pattern made up of dense septa forming loculations; the patchy form is evidenced by fine patchy areas of medullary bone destruction. Generally speaking, the lytic and the patchy types consitute the roentgen appearance expected in the majority of cancer metastases in bone, while the septate form was sufficiently distinctive to warrant assuming renal cancer to be the primary tumor.

Since the purely lytic types of renal cancer metastases have nothing specific in their appearance to distinguish them from metastases of other origin, they must be differentiated from the primary bone tumors, certain infections in bone, and the histiocytoses. The important points in this differentiation are the knowledge of the existence of a primary malignant tumor, multiplicity, the ill-defined edges, the predominance of destruction over production, the scarcity of periosteal reaction, the oval shape, the lack of internal pattern, and the symmetrical tendency.

The above holds true for the most part for the less common patchy type. There is, however, a somewhat greater tendency for the patchy type to resemble Ewing's tumor, primary reticulum-cell sarcoma of bone, and certain infections.

In the authors' opinion the septate form has been responsible for the variety of roentgen diagnoses offered in renal cancer metastatic to bone. The resemblance to benign giant-cell tumor of bone seems a superficial one. The latter tumor should be differentiated by its asymmetrical position, absence of periosteal reaction, epiphyseal relationship, lack of soft-parts extension, frequency of fracture into the joint, the distinct periphery, and above all the internal pattern with its fine regular septation. The roentgenographic characteristics of osteogenic sarcoma should enable one to differentiate it in most instances, for it is pear-shaped, shows a prominent soft-parts mass, and has plentiful periosteal reaction; its borders are indistinct and often production predominates. The essential feature is the disorganization of the internal pattern with amorphous productive areas. Angioma of bone is an uncommon tumor, with such distinguishing features as a regular internal pattern, distinct periphery, absence of soft-parts mass, and absence of cortical destruction.

There are two conditions that somewhat resemble the septate form of metastasis. These are the large, partially loculated type of myeloma which occurs occasionally and which has been reported as "solitary," and a few of the metastases of thyroid origin, especially the "metastasizing struma." The former has been seen in the flat bones. In both conditions the septa are less well developed, scanty, and incomplete, with scalloping at the periphery of the tumor.

Ten roentgenograms.

Observations on the Growth of the Vertebral Body in Scheuermann's Disease. Folke Knutsson. Acta radiol. **30:** 97–104, Aug. 31, 1948.

While growth increment of the long bones has been investigated by marking various points in the growing bone by metal indicators and subsequently measuring the distance between these, no such studies appear to have been carried out on the spine.

By means of serial vertebral films of growing children having Scheuermann's disease, the author has studied the growth increments of the vertebral bodies in that condition. The irregularities of the bodies characteristic of the disease served as "markers" from which measurements were taken. It is shown that anteroposterior growth takes place exclusively in an anterior direction, with no demonstrable increment of growth from the posterior surface. This is believed to be true also of growth under normal conditions.

The disturbance in Scheuermann's disease appears to be in the vertical growth of the vertebral body. This may lead to a sagittal wedge-shape when the anterior sections of the growth zone are predominantly involved, or in other cases to a frontal wedge-shape. In still other instances, the involved vertebrae retain an intact rectangular shape but are lower than the adjoining normal vertebrae, indicating that the disease process is distributed uniformly over the cross-section.

The sagittal wedging of Scheuermann's disease may be differentiated from that associated with compression fracture by the fact that in the former condition the sagittal depth of the involved body is frequently greater than that of the adjacent normal vertebra.

Sixteen roentgenograms. J. D. CALHOUN, M.D.
University of Arkansas

Horner's Syndrome Due to an Osteochondroma of the First Rib. J. F. Simpson. Canad. M. A. J. **59:** 152–155, August 1948.

Horner's syndrome is a relatively uncommon entity characterized by homolateral ptosis (pseudoptosis), miosis, and enophthalmos, and sometimes by other manifestations, such as vasodilatation and anhidrosis. The cause is a lesion involving the cervical sympathetic pathways in the brain stem or spinal cord. Lesions involving the cervical chain are the most commonly implicated.

Among the peripheral lesions causing this syndrome, the most common are: (*a*) injury to the cervical sympathetic chain as a result of operative accident incident to phrenic nerve resection, thoracoplasty, or extrapleural pneumonolysis, (*b*) apical lung neoplasms, (*c*) pressure from a cervical rib, and (*d*) goiter.

The author presents a case of Horner's syndrome caused by an osteochondroma of the posterior third of the left first rib, a very rare entity. The patient, a 34-year-old white female, had had typical symptoms for at least seventeen years, with brachial plexus pressure symptoms beginning at the age of seven, indicating an onset twenty-one years before. The tumor was demonstrated radiologically at the age of seventeen and had remained practically unchanged. It was removed surgically and the diagnosis confirmed by pathologic examination. Eight months after the removal there was clinical evidence of regeneration of the sympathetic nerve fibers involved and no radiologic evidence of recurrence of the tumor.

Eight illustrations, including 3 roentgenograms.
H. J. THOMPSON, JR., M.D.
Jefferson Medical College

Chondroblastic Osteogenic Sarcoma of the Humerus. John Mayo. M. J. Australia **2:** 153–155, Aug. 7, 1948.

This is a report of the preoperative treatment of a highly lethal tumor with heavy irradiation, the author patterning his therapy by that of McNattin (Radiology **42:** 246, 1944), but speeding up the therapy instead of protracting it. The patient was a 21-year-old woman with a chondroblastic tumor of the humerus, which was treated with 3,700 r to each of two pairs of fields diametrically opposed. The anterior, posterior and lateral fields measured 30 × 7 cm.; the medial field measured 24 × 7 cm. The other factors were 185 kv., a Thoraeus filter equal to 1 mm. of copper at that voltage, half-value layer 1.3 mm. of copper, and 50 cm. target-skin distance. Treatment was given over a period of forty-three days so as to deliver a "central dose" of 10,000 r. Four weeks later the margins of the tumor showed better definition roentgenographically. A shoulder girdle amputation was done after two months, and the author states that, while fully three years have passed since the first symptoms appeared, the chest films have been negative and the patient remains healthy.

The author makes the point that results in bone tumors, no matter how they are treated, are quite poor, and that immediate amputation does not produce as good results as amputation preceded by irradiation. He states, further, that as the periosteum is the most effective tissue in delaying the local spread of the disease, he did not consider even an aspiration biopsy justifiable, while the membrane was still intact. [It is of interest to note that even after 10,000 r to the center of this tumor, it was still identifiable, pathologically.]

S. F. THOMAS, M.D.
Palo Alto, Calif.

Aseptic Necrosis of the Head of the Femur Following a Minor Fracture of the Greater Trochanter: Report of a Case. Alfred E. Jackson and William H. Bickel. S. Clin. North America **28:** 1025–1030, August 1948.

Newer methods of treatment of fractures of the neck of the femur have markedly lowered the number of cases of non-union, but aseptic necrosis of the head of the femur still presents a challenging problem. Aseptic necrosis cannot be completely explained on the basis of a disturbed or altered blood supply to the part, because it is frequently seen following what is apparently a rather minor injury or trauma. The necrosis often occurs after the patient has made a complete clinical recovery from the initial trauma and no measures are known that will prevent it or from which one can predict its occurrence. It appears that the longer the patient is kept from bearing weight on the injured femur, the less the amount of femoral head collapse one may expect.

A case history with complete follow-up is presented, with 2 roentgenograms showing the changes that occur in aseptic necrosis of the femoral head following injury or trauma. There was no obvious damage to the capsular or ligamentum teres vessels in this case, but the pathologic process was much the same as that following known disturbances of the blood supply.

C. S. POOL, M.D.
University of Arkansas

Heterotopic Ossification in the Anterior Cruciate Ligament of the Knee Joint. Report of a Case. B. Polonsky. South African M. J. **22:** 452–454, July 24, 1948.

A case is described of ossification in the anterior cruciate ligament of the knee joint, heterotopic in nature, associated with a tear of the internal semilunar cartilage. The exciting factor was most probably trauma. A roentgenogram shows a bony body lying in the inter-

condylar fossa of the left knee; films of the right knee were normal.

Two roentgenograms.

GYNECOLOGY AND OBSTETRICS

X-Ray Study of the Contraceptive Diaphragm in the Vagina. A. P. Hudgins and W. P. Elkin. West. J. Surg. **56:** 437–439, August 1948.

Intravaginal x-ray studies were made of three types of contraceptive diaphragms—coil-spring, watchspring, and dual coil-spring. Each was observed in three patients, representative of different pelvic findings—(1) a nullipara, (2) a multipara with good vaginal and perineal support, (3) a multipara with moderate relaxation of a degree not precluding the satisfactory fitting of a vaginal diaphragm. All of the devices studied assumed approximately the same curve and contour when released under similar intravaginal pressure. The films are reproduced.

Twenty-three roentgenograms.

Early Diagnosed Carcinoma of the Female Genitals. Herbert Deuel. Schweiz. med. Wchnschr. **78:** 713–715, July 24, 1948. (In German)

In the five years, 1942–47, the author found records of 71 cases of early cancer diagnosed in his clinic; 67 were of the cervix uteri. There are microscopically three groups to be distinguished: (1) hyperplasia or atypical growth; (2) beginning cancer; (3) classical cancer. The cases of this series fell mostly in the second group, although they develop out of the first. Hinselmann's colposcopy, biopsy, and microscopic study places all of them in that writer's Group III or IV. Surgical treatment is advised, and for most patients "portio" amputation was carried out; total hysterectomy was used in about a quarter of the cases. The end-results are not reported.

One roentgenogram; 3 photomicrographs; 1 graph.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Roentgen Diagnosis of Placenta Praevia. Herbert Deuel. Radiol. clin. **17:** 232–235, July 1948. (In German)

Roentgen demonstration of the placenta is usually possible by a soft-tissue technic, and without the use of contrast media. Three cases are reported, in 2 of which the placenta was so visualized—one a marginal placenta and the other a total placenta praevia. The third patient had a premature separation of the placenta, which was implanted normally.

Three roentgenograms. LEWIS G. JACOBS, M.D.
Oakland, Calif.

Breech Presentation with Hyperextension of the Neck and Intrauterine Dislocation of Cervical Vertebrae. J. Champneys Taylor. Am. J. Obst. & Gynec. **56:** 381–385, August 1948.

The author reports a case in which a roentgenogram of the abdomen showed a full breech presentation with the arms of the fetus at the sides and the cervical spine in extreme hyperextension. The occiput rested on the lumbar spine. At the thirty-eighth week of gestation an elective section was performed, and a living baby was obtained. When the infant was six days old, roentgenograms of the cervical spine showed forward dislocation of the first, second, and third cervical vertebrae on the fourth. Adequate treatment reduced the dislocation.

This case is reported and the pertinent literature is reviewed in the hope that the obstetrician will become more conscious of deflection attitudes in breech presentations and more mindful of the vulnerability of the cervical spine and cord. It is felt that labor in the presence of hyperextension of the cervical spine could cause fatal damage to the cord. Roentgenography is paramount as an aid to diagnosis.

Five roentgenograms. JOHN DECARLO JR., M.D.
Jefferson Medical College

THE GENITO-URINARY SYSTEM

Present Status of Aortography. William F. Melick and Alvin E. Vitt. J. Urol. **60:** 321–334, August 1948.

The authors recount the early history of aortography and date its general acceptance in this country from the report of Fariñas in 1941 (Am. J. Roentgenol. **46:** 641, 1941). Over 3,000 cases have now been reported without a single fatality. Sodium iodide is the medium customarily employed.

The fact that there are no important structures in the area of injection (just below the twelfth rib and four finger breadths to the left of the spine) that may be accidentally encountered eliminates danger from that source. The possibility of bleeding from puncture of an atheromatous plaque in the presence of severe arteriosclerosis exists, but the authors have obtained arteriograms in arteriosclerotic patients without incident.

The same precautions should be observed in aortography as in intravenous pyelography. The procedure should not be attempted in the presence of severe liver damage, nephritis, uremia, or sensitivity to iodides, and should be used with great caution in patients with pulmonary tuberculosis and hyperthyroidism. The authors test for sensitivity to iodides by a preliminary injection of a few drops of sodium iodide intravenously and give normal saline and vitamin C intravenously immediately after the procedure, as a prophylactic measure. They use a general anesthetic (intravenous sodium pentothal).

For obtaining the pictures, at least a 500-ma. unit is recommended so that exposures can be made at 0.2 second. It is necessary to have a high-speed Bucky diaphragm to obviate motion and grid marks.

By demonstrating the renal blood flow, aortography permits a study of renal functon and disease in cases in which neither retrograde nor intravenous pyelograms can be made. The procedure has been found of value in (1) cases of ureteral blockage associated with a nonfunctioning kidney; (2) extraperitoneal tumors; (3) renal hematuria with a normal pyelogram; (4) renal hematuria with pyelographic deformity; (5) renal tumors; (6) hydronephrosis due to aberrant vessels; (7) renal anomalies; (8) hypertension; (9) renal cysts; (10) certain non-urologic conditions.

Twenty-four illustrations, including 16 roentgenograms. VERN W. RITTER, M.D.
University of Pennsylvania

Use of a Histamine Antagonist in Intravenous Pyelography. Paul L. Getzoff. New Orleans M. & S. J. **101:** 22–25, July 1948.

This is a report of the author's experience with a histamine antagonist in preparation for intravenous

pyelography in 22 patients, all of whom presented histories of allergic manifestations of one or more types. Each of these patients had positive conjunctival and intradermal tests for sensitivity to diodrast. A control group consisted of 50 patients, all of whom had nonallergic histories and negative tests for diodrast sensitivity. The use of a histamine antagonist is based on the belief that the reactions following intravenous injection of contrast media for intravenous pyelography are due to allergic phenomena.

The procedure was as follows. In addition to the usual preparatory measures of restricted fluid intake and purgation, a careful history of clinical allergic manifestations was obtained and a conjunctival and intradermal skin test were done. One hour before the pyelograms were made, 50–100 mg. of "pyribenzamine" were given, depending on the size and age of the patient. The drug is taken by mouth with one-half glass of water. One cubic centimeter of the contrast medium was then injected intravenously with a tuberculin syringe. If there was no reaction after five minutes, the injection was completed. The appearance of any allergic manifestations was a signal for immediate discontinuation of the injection and the administration of epinephrine or ephedrine.

No allergic reaction occurred in the control group. Of the patients in the allergic group 4 (18.2 per cent) gave general sensitivity reactions. There were no fatalities. It is concluded that the diminution in sensitivity reactions in patients with various allergic disorders and manifest positive reactions to sensitivity tests justifies continued use of this technic.

WYNTON H. CARROLL, M.D.
The Henry Ford Hospital

Radiographic Picture of Diverticulum of the Renal Pelvis. Vladimir Stašek. Radiol. clin. **17:** 185–193, July 1948. (In French)

A diverticulum of the renal pelvis, apparently the first diagnosed during life, was demonstrated by intravenous urography in a 64-year-old woman. It consisted of a saccular pouch with smooth and flaccid walls projecting from the lower portion of the left kidney pelvis and communicating with it by a stalk-like connection. Drainage films showed retention in the diverticulum. Nephrectomy led to a good immediate result; pathological study of the specimen showed a purulent pyelonephritis and a renal abscess as well as the diverticulum. The author suggests that the formation of the diverticulum involves both pressure effects of a hydronephrosis and a congenital weakness of the connective tissue in the wall of the renal pelvis.

Five roentgenograms.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Calcified Aneurism of the Renal Artery. Report of a Case. William R. Davis and Leonardo F. Gallardo. J. Philippine M. A. **24:** 375–380, July 1948.

A case is reported to call attention to the possibility of renal artery aneurysm in patients presenting rather typical symptoms of renal stone. Despite the rarity of this condition (one in 6,000 autopsies), it should not be overlooked.

True and false aneurysms are differentiated: false aneurysm is considered a complication of rupture of the kidney, though in a great many cases of true aneurysm there is also a history of trauma. In elderly persons the lesion is usually attributed to arteriosclerosis (a history of syphilis is usually absent), while in younger persons there is more often evidence of trauma to the flank or loin. Aneurysms develop very slowly after trauma and many of them are calcified when first seen.

The symptoms of this condition in young persons differ from those in the elderly. In the former, there are usually no symptoms before rupture; in the latter pain and hematuria occur. Rupture is attended by severe local pain radiating to the testicle or thigh, and shock. The patient is often moribund when first seen. Perirenal swelling occurs in half of the cases, and hematuria in a third.

The case reported is that of a 57-year-old Negro with left renal colic; the pain radiated to the left testis and was aggravated by straining at stool. After a complete urological study, including the roentgen demonstration of an area of calcification at the level of the left kidney, a diagnosis of renal stone was made. Eventually the kidney was explored. A calcified mass was palpated in the pedicle, dissection of which revealed an aneurysm of the left renal artery just proximal to the pelvis. Nephrectomy was done and recovery was uneventful.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Further Studies of the Interureteric Ridge of the Bladder. Nils P. G. Edling. Acta radiol. **30:** 69–75, Aug. 31, 1948.

In an earlier paper (Acta radiol. **22:** 573, 1941. Abst. in Radiology **40:** 109, 1943) the writer described the appearance of the interureteric ridge in the cystogram, suggesting its study as an aid in the diagnosis of intramural ureteral calculi. He has now accumulated 135 cases with symptoms of ureteral calculi in which such a study has been made. He points out that proper technic must be used: a heavy exposure with the central ray passing through the bladder in the true anteroposterior direction (coronal plane).

The normal interureteric ridge in this projection shows up as a smooth curve with the apex toward the urethral orifice. A reversal of one side of the curve, *i.e.*, convex cephalad, may indicate swelling of the wall of the intramural part of the ureter. The author suggests this as an indirect sign of a calculus having been or actually being present in the region.

Seven roentgenograms; 1 photograph.

ERNEST S. KEREKES, M.D.
University of Arkansas

Giant Prostate Without Symptoms: Neurofibroma. Harry G. McGavran. J. Urol. **60:** 254–259, August 1948.

The author reports a neurofibroma of the prostate weighing 839.5 gm., which was successfully removed by a retropubic approach. The patient was a 44-year-old male with a five-year history of right-sided low back pain and difficult and painful bowel movements of three years duration. The mass was palpable by rectal examination and upon abdominal palpation it extended three finger breadths above the symphysis pubis. A cystourethrogram revealed marked displacement of the bladder upward and to the left, with elongation of the posterior urethra, which was displaced to the left lateral pelvic wall. In addition, there was complete absence, roentgenographically, of the body and superior and inferior rami of the right os pubis.

At operation, the tumor was found filling the entire bony pelvis and was readily separated from its capsule. The mass measured 18 × 18 × 10 cm. This is the second largest benign tumor of the prostate and the second neurofibroma of the prostate to be reported in the literature.

Seven roentgenograms; 1 photomicrograph.

D. B. NAGLE, M.D.
University of Pennsylvania

Urographic Findings in Cases of Tumor of the Suprarenal Gland. Joseph H. Kaplan and Laurence F. Greene. S. Clin. North America **28:** 1071–1078, August 1948.

This article reports a study of 72 cases in which excretory urography was done in an effort to evaluate this procedure as a diagnostic aid in the detection of tumors of the suprarenal gland. In all of the 72 cases the clinical picture suggested the presence of a suprarenal tumor.

The two diagnostic signs sought after were downward displacement of the kidney and the presence of a soft-tissue mass in the region of the suprarenal. Either one or both of these signs were demonstrable in 29 out of 39 proved cases in this series, indicating that excretory urography is a valuable diagnostic adjunct to the diagnosis of suprarenal tumors. There was no relationship between the type of tumor and the positive urographic findings.

Eight roentgenograms; 1 table.

JOE B. SCRUGGS, JR., M.D.
University of Arkansas

THE SPINAL CORD

Neurosurgical Lesions Diagnosed as Multiple Sclerosis. Samuel Rosner. J. Nerv. & Ment. Dis. **108:** 113–117, August 1948.

The author presents 3 cases to indicate the value of myelography in demonstrating the presence of neurosurgical lesions which may be corrected in patients presenting an atypical multiple sclerosis syndrome. He feels that this procedure should be attempted in patients who do not show a typical Charcot's syndrome but do show one or more of the following: positive or partial Queckenstedt, sensory level, increased spinal fluid protein (above 40 mg. per cent).

The technic is described: 6 c.c. of pantopaque is injected into the cisterna magna followed by myelography of the cervical region, spot films being obtained wherever any deviation from normal is observed fluoroscopically. The oil is collected in the caudal sac and removed by lumbar puncture.

Case 1 presented a sensory level at C_6 among other findings for multiple sclerosis. The myelogram demonstrated a defect at the superior border of C_5 on the right, which was found at operation to be due to an adhesive arachnoiditis constricting the cord at C_4 to C_5.

Case 2 also presented a sensory level at C_6 and the myelogram demonstrated a midline defect at the interspace between C_5 and C_6. Two fibromatous extradural tumors were found at the level of C_5 and C_6 at operation.

Case 3 had an elevated cerebrospinal fluid protein and myelography showed a block at D_2-D_3 on the right and D_3-D_4 on the left. Two osteochondromata were found at operation, compressing the cord at the levels seen on myelography.

Two roentgenograms.

DONALD R. BRYANT, M.D.
The Henry Ford Hospital

Varicosities of the Spinal Cord Veins. A Case Report. S. M. Katz and Eric Samuel. South African M. J. **22:** 507–509, Aug. 28, 1948.

A case of arteriovenous angioma of the spinal cord is presented as illustrating the characteristic radiologic appearance and the lack of diagnostic clinical findings. Signs and symptoms are extremely variable. In the early stages sensory symptoms predominate; later, pressure effects may produce motor dysfunction. Myelograms of the authors' case showed irregular tortuous filling defects, which were continuous. The radiologic diagnosis lay between a venous angioma of the spinal canal and localized arachnoiditis. The worm-like appearance of the filling defect was thought to favor hemangioma. This diagnosis was confirmed at operation.

Two myelograms.

S. F. THOMAS, M.D.
Palo Alto, Calif.

THE BLOOD VESSELS

Roentgen Examinations of the Soft Tissue in Acute Thrombosis. J. Frimann-Dahl. Acta radiol. **30:** 1–8, Aug. 31, 1948.

The author describes a soft-tissue technic to demonstrate changes occurring in acute thrombosis of the lower extremities. These changes are apparently due to edema of the subcutaneous tissues and the following points are typical: (1) thickening of cutis line, (2) increased breadth of the subcutaneous fat layer, (3) abnormal network-like designs in the subcutaneous tissue, (4) increased density of the muscular shadow and blurring of the border of the muscle mass adjacent to the subcutaneous fat. Sometimes one sees a dilatation of collaterals and broadening of the saphenous vein without injection of any contrast medium.

In 34 cases with clinical signs of thrombosis the roentgen findings were negative in 4 cases. In 2 cases the clinical and radiographic diagnoses were both doubtful and in 3 cases there were positive radiographic findings while clinical findings were still negative. The method was found to be better in women than in men because of the heavier layers of fat.

The roentgen findings, of course, are not specific for acute thrombosis; similar pictures are seen in fractures, hematomas, cellulitis, and osteomyelitis. Venography was used also in a number of these cases to confirm the findings, but the relative ease with which soft-tissue roentgenography can be done and the ease of securing serial studies should give it a place in acute thrombosis.

The illustrations are of superior quality; soft tissue detail is well shown by use of a "tone-separation" method of reproduction.

Two roentgenograms; 1 drawing.

G. REGNIER, M.D.
University of Arkansas

Studies in Experimental Frostbite. II. Arteriograms. Harris B. Shumacker, Jr., Beverly H. White, and Earle L. Wrenn. Yale J. Biol. & Med. **20:** 519–531, July 1948.

In experimental frostbite, gangrene due to vascular alterations can sometimes be forestalled by preventing arterial thrombosis with anticoagulant therapy. Arteriography can be used to evaluate the arterial circulation, especially as to presence or absence of vascular occlusion and possibly as to the state of constriction or dilatation, though no direct information is given concerning arteriolar or capillary blood flow or of circula-

tion through the arteriovenous shunts. Lack of visualization of an artery, therefore, may be due either to obstruction or to occlusion of a patent vessel by segmental or general arterial spasm.

The authors' experiments—on dogs and rabbits—demonstrated a normal arterial network in extremities which survived experimental frostbite without gangrene by virtue of successful treatment with anticoagulant therapy. In the presence of gangrene, there was non-visualization of the arterial tree beyond and proximal to the gangrenous area, due to the thrombosis present.

Arterial channels were functionally closed in the frozen area; in the area just proximal, the arteries were generally not open during, and for a short time after, freezing.

Fourteen good arteriographic reproductions, accompany the article. Seven tables.

ERNEST S. KEREKES, M.D.
University of Arkansas

TECHNIC

Rubber Cassette with Intensifying Screens Designed for Roentgen Examination of Operatively Exposed Organs. Olle Olsson. Acta radiol. **30:** 91–96, Aug. 31, 1948.

For the radiographic study of operatively exposed organs, the author has devised a rubber cassette similar to the cassettes used in industry for the inspection of material. It consists of a flat rubber bag, 10 × 15 cm., in which are placed the film and two flexible intensifying screens, also of the industrial type. The cassette is sterilized and loaded under sterile precautions, and the air drawn out by means of a small tube and a syringe. The cassette is then introduced into the operative wound.

The principal application of this technic is in the location of calculi in a kidney at the time of operation.

Two photographs.

JOE B. SCRUGGS, JR., M.D.
University of Arkansas

RADIOTHERAPY

Contact Roentgen Therapy. George C. Andrews. Arch. Dermat. & Syph. **58:** 118–126, August 1948.

The author discusses contact therapy of cutaneous diseases with particular reference to the Philips tube and apparatus. The radiation from the Philips tube is compared with that produced by radium applicators, based on data from the papers on this subject by Braestrup and Quimby.

The author's results with the Philips tube in the treatment of *epitheliomas* are no better and often are not as good as those obtained with standard superficial therapy machines with unfiltered radiation produced at 600 or 100 kv. The advantage of the Philips tube lies in the protection of the deeper structures and the rapidity with which larger doses can be given. This makes it especially suitable for treatment of cancer of the eyelids.

With the Philips apparatus, 8,000 to 16,000 r, unfiltered except for the filtration inherent in the tube, are given in divided doses in eight to twelve exposures over a period of two to three weeks, the size of the dose depending upon the thickness or depth and the size of the epithelioma, the amount of subcutaneous tissue, the proximity of bone or cartilage, and the patient's age and type of skin. These large doses cause severe reactions which, however, are superficial and heal with surprisingly little scarring. For large epitheliomas, the small size of the Philips tube is often inadequate and the size of the field covered by standard superficial therapy units is an advantage.

The technic advised by Pendergrass (Radiology **37:** 550, 1941) for the treatment of *hemangiomas* with the Philips apparatus has formed the basis of the author's work. He believes, however, that the quality of radiation from the Philips apparatus is not as suitable as that from radium applicators for the treatment of hemangiomas and that the harder radiation from the Chaoul tube is superior to the radiation from the Philips tube for this purpose.

The Philips tube is especially useful in the treatment of *warts* because of the large output. The average dose, unfiltered, for small warts is 2,500 to 3,500 r; this is delivered in a few seconds. For plantar warts a dose of 3,500 r is often used.

For *senile and seborrheic keratoses*, the average dose is 1,200 r unfiltered. The skin about the keratosis is closely shielded. The cosmetic results are good.

The chief advantage of the Philips tube lies in the tremendous output made possible by the short target-skin distance. It saves a great deal of time. Also, the absorption of the major portion of the output within the upper centimeter of tissue gives relative protection to deeper structures. Considerable amounts of stray radiation develop around the tube, and the operator, to be safely protected, must wear a lead-rubber fluoroscopic apron and lead rubber gloves during treatments if more than two or three are given daily.

Andrews considers the portable feature of little practical value and believes that, if this feature were done away with, and safety and stability were substituted for it by the use of a protective screen and a good counterbalanced tube stand, wider use of the apparatus would be encouraged.

Skin Cancer. Galen M. Tice and Charles M. White J. Kansas M. Soc. **49:** 324–332, August 1948.

This paper should be read in its entirety because of the authors' excellent approach to the problem of skin cancer and also for their extensive but concise comparisons of therapy by leading authorities. There have been as many ways of treating skin cancer, they state, as there have been men doing it. This they believe is probably a good thing, for cases are thus individualized.

The authors' general plan of treatment is the massive or intensive type, 1,250 r (measured in air) being given daily for four days at 90 kv.p. The skin-target distance is 8 to 12 inches. No filter is used the first two days, and 0.5 mm. of Al is used the last two days, or in the thicker lesions, 1.0 mm. of Al. In some of the larger lesions, a smaller total dose than 5,000 r (air) is used, because of backscatter. If much necrotic tissue is present, this is first removed by the plastic surgeon.

Lesions of the nose are treated like lesions elsewhere, except that 0.5 mm. Al filtration is used throughout. Epitheliomas of the pinna of the ear are similarly handled, but there have been numerous recurrences with the squamous-cell variety, and surgery may be preferable in this type. When treating lesions of the eyelids, the globe is protected by a special lead shield.

Causes for recurrence are listed, and the authors warn against inadequate dosage and too close shielding of the lesion. Recurrence is commoner in the more extensive lesions, and where there is underlying cartilage.

The authors' cure rate (1 year or more) is 90 per cent for basal-cell lesions and 80 per cent for the squamous type. Their only significant complication was chronic radiation ulcer (4.6 per cent of all cases irradiated).

Tables are included with respect to sex incidence, location of lesion, cures, recurrences, and failures in the authors' series of 363 cases (358 patients) and showing the cure rates reported by others.

Twelve photographs; 10 tables.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Malignant Melanoma of the Skin. Clinical and Pathologic Analysis of 75 Cases. Lauren V. Ackerman. Am. J. Clin. Path. **18:** 602–624, August 1948.

This study concerns the clinical and pathologic features of 75 cases of malignant melanoma of the skin, of which 44 were in men and 31 in women. It does not include malignant melanoma of the oral cavity, eye, vulva, or anus. Thirty-five per cent of the lesions occurred in the lower extremities, and 32 per cent in the region of the head and neck. In 46 (61 per cent) cases there was a pre-existing mole; in 15 the mole had been present since birth. A mole preceded the development of tumor most frequently in the lower extremities.

Treatment of malignant melanoma must be radical surgical excision followed by radical dissection of regional lymph node areas when predictable. All forms of compromise therapy, including irradiation, are contraindicated. With the idea of palliation only, 3 patients in this group received radiotherapy. The first presented a local recurrence and the other 2 had metastatic inguinal nodes. Rather marked local regression of the lesion was seen in the patient with recurrence and in one of those with inguinal metastases, but in each instance this was followed by increased growth of the tumor, distant metastases, and death. In 2 other patients, because of an error in the pathological diagnosis, a primary malignant melanoma was treated with the usual adequate radiotherapeutic dose for skin carcinoma, with no beneficial effect.

In spite of the ominous character of malignant melanoma, 8 of 21 patients (38 per cent) in this series treated by radical excision and radical dissection survived five years; 3 of the 8 had regional lymph node involvement. If 22 other hopelessly far-advanced cases which appeared during the same period are included, the percentage of survival for five years is 19 per cent.

Four tables; 17 illustrations.

Some Considerations in the Treatment of Hemangioma in Infants and Young Children. Eugene P. Pendergrass, James C. Katterjohn, and James B. Butchart. Am. J. Roentgenol. **60:** 182–192, August 1948.

This article is based on experience in the treatment of 560 hemangiomas in 406 patients since 1938. Three general types are recognized: (1) a flat superficial plexus of dilated capillaries—angioma simplex and nævus flammeus or port-wine stain; (2) hypertrophic angiomas made up of an interlacing network of blood vessels of considerable size—angioma plexiforme and angioma simplex hyperplasticum; (3) cavernous hemangiomas.

The authors strongly condemn delay in the treatment of hemangiomas in the hope that they will disappear spontaneously—a method frequently recommended by physicians. They are also cognizant of the opposition even among radiologists to irradiation of these lesions. They feel, however, that small doses of radiation, properly given at the earliest possible time, *i.e.*, within the first few weeks of life, offer excellent results.

The form of irradiation varies with the type and location treated. The authors prefer contact therapy with the Chaoul or Philips units, rather than topical radium. Large and bulky lesions are treated with intermediate voltage, 75 to 135 kv. The general plan of the treatment is to give small doses of 200–400 roentgens (measured in air) every four to six weeks. In large lesions, multiple small ports are employed, making no effort to have the ports overlap. The total dose is usually less than 1,500 r. Small deep-seated hemangiomas may be treated by radon seeds after the skin discoloration has been removed by roentgen therapy.

Several points are emphasized. The treatment should begin at as early an age as possible: lesions at three months generally require more treatment than at three weeks. The family should be forewarned of all the possible radiation reactions. In large bulky lesions, sloughs occur more frequently without irradiation than with it. The color of the lesion is first matched with fingernail polish color charts as a baseline for the response to the treatment.

Twelve illustrations, including 4 roentgenograms.

JOSEPH D. CALHOUN, M.D.
University of Arkansas

Hemangiopericytoma. Charles F. Sims, Neville Kirsch, and R. Gordon MacDonald. Arch. Dermat. & Syph. **58:** 194–205, August 1948.

The authors report two cases of hemangiopericytoma, a vascular tumor characterized by the formation of endothelial tubes and sprouts with a surrounding sheath of rounded and sometimes elongated cells derived from the capillary pericytes. In one case the tumor was a composite one, containing endothelial cells as well as pericytes. It was treated by roentgen rays with notable improvement, but the interval was too brief to permit any conclusion as to the permanency of the result.

Eight illustrations.

Treatment of Carcinoma of the Lip with High Voltage X-Ray. H. B. Ivey. South. M. J. **41:** 685–688, August 1948.

The author treats cancer of the lip with 5,000 to 6,000 r, at 200 kv.p., 25 cm. distance, 2 mm. copper and 1 mm. aluminum filtration. The patient is treated five to six days each week, receiving an average daily dose of 300 r. This technic has been used in 109 cases of carcinoma of the lip, with only 5 failures. There have been no irradiation complications. The percentage of recurrence for the entire 109 cases is 4.5. All the patients with recurrences died of metastatic disease.

Two photographs.

JOHN DECARLO JR., M.D.
Jefferson Medical College

Malignant Tumors of the Nose and Nasal Accessory Sinuses. LeRoy A. Schall. J. A. M. A. **137:** 1273–1276, Aug. 7, 1948.

In malignant tumors of the nose and paranasal sinuses, surgery as the primary form of treatment with

radiation therapy as an adjunct has produced the best results in terms of five-year survivals. Of 123 patients treated in this way, 48 (39 per cent) are living after five years. The five-year survival rate for patients treated primarily by radiation was 19 per cent. The importance of biopsy is rightly stressed as a prerequisite to therapy. Several illustrative case summaries are included. PAUL W. ROMAN, M.D.
Baltimore, Md.

Colloidal Lead Orthophosphate Associated with Deep Roentgen Therapy in Bone Metastases from Cancer of the Breast. Lawrence Reynolds, T. Leucutia, James C. Cook, and Kenneth E. Corrigan. Am. J. Roentgenol. **60:** 193–206, August 1948.

The authors review the literature and conclude that colloidal lead orthophosphate is considerably more stable and less toxic than the electric suspension of metallic lead used by Bell (see, for example, Lancet **1:** 537, 1926) for the treatment of cancer.

Diffraction studies performed in rabbits confirmed the affinity of the lead for the osseous system, the largest deposition occurring along the epiphyseal lines and at the place of most active cell growth. Apparently the lead replaces, for a limited time, the part that calcium normally plays in bone metabolism.

The preliminary intravenous injection of colloidal lead orthophosphate in conjunction with roentgen therapy leads to a three-fold effect in the malignant neoplastic invasion of the osseous system: (1) the lead has a certain toxic action in itself; (2) there is a direct destructive effect of the roentgen rays; and (3) the heavy lead atoms deposited within the tumor area emit, under the influence of the roentgen irradiation, ionizing secondary electrons which also act on the carcinoma cells.

The method has been used during the past twenty years in a series of 355 cases of bone metastases chiefly from carcinoma of the breast. In 95 per cent of the cases the immediate palliative effect was remarkable. The average survival amounted to three years. In 4 per cent the survival was more than five years. There was one ten-year survival, but no permanent cure.

The authors have also tried radioactive lead orthophosphate, but state that further investigations are necessary before worth-while therapeutic efforts can be undertaken.

A very complete bibliography is appended.

Twenty-one illustrations, including 19 roentgenograms. ERNEST S. KEREKES, M.D.
University of Arkansas

Surgical and Radiation Therapy for Carcinoma of the Cervix. Manuel Garcia and Leon J. Menville. J. A. M. A. **137:** 1101–1109, July 24, 1948.

In comparing surgical with radiation therapy for carcinoma of the cervix, the authors insist on the use of the absolute salvage rate. This means the proportion of patients alive and well at the end of five years, whether treated or not. Surgical judgment has limited the number of operative patients and has frequently indicated the additional use of radiation. Even so, recurrence of the disease is found in the pelvis in one third of those surviving operation, in the majority of cases appearing within three years. When surgery alone is used, the absolute salvage rate is 22 per cent. The absolute salvage percentage for surgery and radiation is 32 per cent. It is felt that combining radiation with surgical therapy has improved the end-results even though the amount of radiation is not considered lethal to the residual cancer cells.

Radiation retains its unchallenged position in palliative treatment. As a curative measure, the absolute salvage rate of radiation alone is 33 per cent.

Of interest is the ten-year survival rate for radiation and surgery. This is found to be the same for both. Since operation is done on a more favorable group of cases, it would be expected that the ten-year survival would be greater in that group.

It is stated that surgery has reached its zenith, whereas radiation therapy is capable of further improvement. The figures in this paper represent numerous series reported in the literature.

Three charts; 12 tables. PAUL W. ROMAN, M.D.
Baltimore, Md.

Depth Dose Measurements in the Esophagus in Roentgen Rotation Therapy. Kurt Lidén. Acta radiol. **30:** 64–68, Aug. 31, 1948.

In rotation therapy, accurate theoretical calculations of depth doses are extremely difficult for the following reasons: (*a*) The shape of the cross section of most parts of the human body is not easily susceptible to mathematical calculation. (*b*) The different body tissues have widely differing powers of absorption. (*c*) There are great differences between individual patients. (*d*) It is sometimes difficult to keep the object of the treatment, an esophageal cancer, for example, coincident with the rotation center because of movements of the patient.

An apparatus, consisting of a small cylindrical capsule of aluminum mounted on an esophageal bougie forming a container for two cylindrical condenser chambers, is described. With this apparatus, depth doses in rotation therapy can be determined accurately, as in cases of cancer in the throat and esophagus.

No actual depth dose graphs or charts are given.

Three illustrations. J. D. CALHOUN, M.D.
University of Arkansas

Hodgkin's Disease: An Unusual Case with Spinal Symptoms. O. D. Beresford and Norman G. B. McLetchie. Brit. M. J. **2:** 136–137, July 17, 1948.

A case of Hodgkin's disease involving the cervical and axillary nodes is described. Treatment with deep roentgen therapy resulted in a remission of three and a half years. The patient then returned with a mass in the right iliac fossa, and symptoms of paraplegia consistent with a transverse myelitis subsequently developed. Radiotherapy was again administered, but the course was downhill. At autopsy no trace of lymphadenoma or other lesion could be found to account for the transverse myelitis.

Spinal symptoms, though rare in Hodgkin's disease, are not unknown. Possible causes are: (1) destruction of the vertebral bodies by lymphadenoma with subsequent collapse and compression fracture of vertebrae; (2) pressure on the cord as the result of direct extension of the disease from involved vertebrae; (3) growth of lymphadenomatous tissue in the epidural space adherent to the dura (most common cause); (4) viral or toxic reaction producing edema of the cord. Though the usual finding is an isolated epidural mass, a few cases are not immediately explicable on this basis, either having an epidural mass too small to produce symptoms, or none at all. In several cases reported by Weil

(Arch. Neurol. & Psychiat. **26:** 1009, 1931), all of which had received radiotherapy, only epidural scarring was present. This he interpreted as indicating that lymphadenoma tissue capable of producing symptoms had previously existed. A similar explanation may hold in the present case. LOUIS BERNSTEIN, M.D.
Hartford, Conn.

Experiences in the Treatment of Lymphogranulomatosis and Leukemia with Mustard Gas. Albert Alder. Schweiz. med. Wchnschr. **78:** 729–732, July 31, 1948. (In German)

The author discusses the application of nitrogen mustard to the therapy of Hodgkin's disease and leukemia, with a review of the literature and a report of 10 cases in which immediate benefit was induced by this means. As the follow-up period was short, late results could not be evaluated. He feels that this drug has a place in the therapy of these diseases, although its effectiveness as compared with arsenotherapy and irradiation is yet to be clarified.

Two roentgenograms; 1 chart.
LEWIS G. JACOBS, M.D.
Oakland, Calif.

Inflammation as Considered by the Radiologist. Thomas M. Fullenlove. California Med. **69:** 127–130, August 1948.

The progress of tissue reaction in an inflammation is due to: (1) increased fluid passage through the capillary endothelial wall; (2) localization of the irritant, due to passage of fibrinogen through the capillary wall and blocking of the lymphatics by thrombi and a fibrinous network; (3) migration of leukocytes to the inflamed area with subsequent freeing of leukotoxine. As the inflammation increases, there is a rise in lactic acid formation resulting in a true lactic acidosis.

The action of x-rays in inflammation may be summarized as follows: (1) production of capillary hyperemia; (2) destruction of white blood cells with release of proteolytic enzyme, which dissolves dead tissue; (3) change in the permeability, the hydrogen ion concentration, and the carbohydrate metabolism of the injured cells and surrounding blood plasma; (4) increase of the phagocytic property of the leukocytes, with an antitoxic physiochemical change in the plasma; (5) destruction of young fibroblasts (with larger total dosage).

One diagram. MAURICE D. SACHS, M.D.
Cleveland, Ohio

Lymphoid Eustachian Salpingitis: Its Effect on Tubal Patency. Selective Criteria for Nasopharyngeal Irradiation. J. Brown Farrior. Arch. Otolaryng. **48:** 221–228, August 1948.

Lymphoid eustachian salpingitis, or lymphoid tubotympanitis, is defined as any lymphoid hyperplasia in or about the eustachian tube which interferes with the physiologic opening of the tube and produces symptoms referable to the middle ear. It is usually associated with a chronic catarrhal inflammatory process.

It is important in deciding the type of irradiation to be employed in treating lymphoid eustachian salpingitis to determine the position of the obstruction. Central obstruction, at the pharyngeal orifice of the eustachian tube, will receive maximum benefit from the nasopharyngeal application of radium or of radon. Peripheral obstruction is beyond the effective range of the nasopharyngeal applicator and should be treated by high-voltage roentgen rays.

In the present study, the quantitative degree of obstruction of the eustachian tube was measured with a mercurial manometer; first, the number of millimeters of mercury pressure required for the patient to autoinflate the middle ear was obtained (the degree of central obstruction) and then the number of millimeters of mercury pressure required to inflate the middle ear through the eustachian catheter (the degree of peripheral obstruction). The apparatus and the technic of its use are described.

One hundred diseased eustachian tubes, exhibiting moderate to severe lymphoid hypertrophy about the pharyngeal orifice associated with extensive changes in the tympanitic membrane, were studied. In 81 per cent it was not possible to autoinflate the middle ear by Valsalva's maneuver. Examination revealed no evidence of obstruction peripheral to the pharyngeal orifice in 61 per cent, mild obstruction peripheral to the pharyngeal orifice in 15 per cent, and moderate or considerable obstruction peripheral to the pharyngeal orifice in 24 per cent.

The use of the nasopharyngeal radium applicator is indicated only when there is objective evidence of lymphoid hyperplasia and demonstrable impairment of tubal patency.

Three illustrations.

Techniques for Application of the Betatron to Medical Therapy. G. D. Adams, G M. Almy, S. M. Dancoff, A. O. Hanson, D. W. Kerst, H. W. Koch, E. F. Lanzl, L. H. Lanzl, J. S. Laughlin, H. Quastler, D. E. Riesen, C. S. Robinson, and L. S. Skaggs. Am. J. Roentgenol. **60:** 153–157, August 1948.

The high-energy roentgen-ray beam of the betatron has qualities which should make it useful in the treatment of deep-seated cancers. The rays are very penetrating and have negligible lateral scatter. The elementary biological effects of high-energy rays, as far as examined, have been found to compare closely with those rays of conventional energy. Thus the introduction of the betatron into cancer therapy is largely a question of developing technics.

The authors consider somewhat briefly dosage measurement and evaluation, collimation of beam, shielding of stray radiation, compensating filter, and monitoring of irradiations. Several interesting points are brought out:

The dosimetry of high-energy roentgen rays in absolute roentgens (r) is impractical with standard open chambers. Tissue doses obtained with the Victoreen 25-r condenser chamber in a suitable phantom have been used as a preliminary standard, the readings being calibrated in relation to 200-kv. roentgen rays by quantitative biological tests. At present, the high-energy ray doses are multiplied by a factor of 0.75 to obtain approximate biological equivalence with rays of conventional energy.

In a beam of high-energy roentgen rays, the surface is not the locus of maximum energy absorption. For this reason it is recommended that all tissue dosage be expressed in percentage of maximum tissue dose which, in a 22 million electron volt roentgen-ray beam, is about 4 cm. below the surface.

Collimation of the beam is by means of 2-1/2 inches of lead with a channel of desired shape. The lead of the

collimator transmits 6 per cent of the incident roentgen ray intensity at 20 mev., and this is further reduced to less than 1 per cent by a second solid lead shield.

Protection against stray radiation requires two kinds of shields: (1) material of low-atomic number to absorb stray electrons with relatively low production of secondary roentgen rays and (2) material of high-atomic number, such as lead, to absorb stray roentgen rays.

Four drawings, including isodose curves.

JOSEPH D. CALHOUN, M.D.
University of Arkansas

Intensity Distribution of the 2 Gr Teleradium Unit of the King Gustaf V's Jubilee Clinic in Lund. Kurt Lidén. Acta radiol. **30:** 76–80, Aug. 31, 1948.

A description of a teleradium unit at Jubilee Clinic in Lund is given. Forty tubes, each containing 50 mg. radium element, are distributed along two concentric circles arranged in a circular pattern so that a conical lead-tungsten filter can be used. The containers are attached to the end of a steel ribbon wrapped around a lead, motor-driven wheel. As the wheel rotates, the container moves from a protected position in five to six seconds to the nozzle of the unit. For treatments, the nozzle is placed in the desired position, the motor is started from a control room, and a synchronized clock is set for the desired treatment time. When treatment is completed, the clock again starts the motor and the radium is put in its former protected position. A relay is mounted for a mechanical clock in case of a power failure so that the treatment time is always correct.

Depth doses obtained with the unit were measured, using two paraffin phantoms with holes fixed at proper positions, and the surface intensity was determined with needle chambers. Isodose curves are reproduced.

The distribution of the radium and the radium-skin distance have given intensities and relative depth doses which allow such treatment times as are desirable from the clinical point of view. With a cone, a surface dose of 1,000 r is obtained in 113 minutes and without a cone in 82 minutes.

C. S. POOL, M.D.
University of Arkansas

RADIOACTIVE ISOTOPES

Urinary Excretion of Radioactive Iodine as an Aid in the Diagnosis of Hyperthyroidism. Janet W. McArthur, Rulon W. Rawson, Rex G. Fluharty, and J. H. Means. Ann. Int. Med. **29:** 229–237, August 1948.

Clinical determination of iodine tolerance has been attempted in a number of ways, among which is quantitation of the amount of the element excreted in the urine during a given period of time after the administration of a standard dose. The precision and ease with which the urinary excretion of iodine can be determined have been greatly enhanced by the introduction of its radioactive isotopes. Moreover, a dynamic conception of iodine metabolism can be gained, since the iodine administered in the test dose becomes distinguishable from iodine already present in the body.

The authors have attempted to evaluate the clinical usefulness of the measurement of radioactive iodine excretion by defining more precisely the range of excretion to be anticipated in non-thyrotoxic individuals and in patients with hyperthyroidism. Tracer doses (2 to 160 gamma) of sodium iodide labeled with radioactive iodine (I^{131}) whose specific activity varied from 50 to 2,000 microcuries (in the majority of instances 100 microcuries) were administered orally to 30 non-thyrotoxic persons and 22 patients with classic untreated Graves' disease. Urines were collected for forty-eight hours thereafter, and the percentage excretion determined from the specific activity of an aliquot. A number of seemingly toxic patients had no palpable goiter. To these individuals a dose of radioactive iodine was administered and the entire body searched for iodine-concentrating tissue twenty-four to thirty-six hours later with the Geiger counter.

The mean radioactive iodine excretion by the 30 non-thyrotoxic patients was 60 per cent, with a range of 23 to 98 per cent; the mean excretion by the 22 thyrotoxic patients was 25 per cent, with a range of 7 to 45 per cent. There is thus a considerable overlapping between the two groups in the 20 to 40 per cent range.

The finding of a low urinary excretion of radioactive iodine aided in establishing the diagnosis of Graves' disease in clinically equivocal cases. The finding of a high urinary excretion of radioactive iodine was of assistance in excluding Graves' disease in borderline cases in which a truly basal metabolic rate could not be obtained. In that group of patients exhibiting an intermediate (20 to 40 per cent) excretion of radioactive iodine, the diagnosis of Graves' disease must be established by other clinical and laboratory findings.

Search for external gamma radiation with the Geiger-Müller counter following the administration of a tracer dose of radioactive iodine enables the location of thyroid tissue to be established when doubt exists.

Two charts; 3 tables.

STEPHEN N. TAGER, M.D.
Danville, Ill.

Use of Radioactive Iodine in the Diagnosis of Thyroid Disease. Sergei Feitelberg, Paul E. Kaunitz, Louis R. Wasserman, and Stephen B. Yohalem. Am. J. M. Sc. **216:** 129–135, August 1948.

A Geiger-Müller tube enclosed in lead to collimate the measured radiation was passed over the head and neck in cephalo-caudad and transverse directions one to two days after the administration of I^{131} by mouth. The number of counts per second was recorded in graphs, which were called the vertical and horizontal profile, respectively. In this manner the presence of functioning thyroid tissue was determined and also its distribution and relative amount. This procedure, however, could not be considered definitive in diagnosing thyroid disease. It could not, for instance, distinguish between colloid cyst and non-functioning carcinoma, nor between active carcinoma and adenoma. Cases of diffuse toxic goiter, aberrant thyroid, non-toxic thyroid adenoma, colloid cyst of the thyroid, and carcinoma of the thyroid were studied.

Nine graphs.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Clinical and Laboratory Studies on the Uptake of Radioactive Phosphorus by Lesions of the Breast. H. J. McCorkle, B. V. A. Low-Beer, H. Glenn Bell, and Robert S. Stone. Surgery **24:** 409–415, August 1948.

In 1946 the authors published in RADIOLOGY (47: 492) a preliminary study of the measurement of radio-

active phosphorus in breast tumors by a Geiger-Müller counter applied to the overlying skin. At that time studies had been made in 25 patients. The number has now increased to 80, for 62 of whom complete clinical, radiologic, and pathologic data are available. This latter figure includes 22 with benign and 41 with malignant breast lesions.

The skin surface measurements in 16 of the benign group were comparable to those of normal skin forty-eight hours following tracer doses of radioactive phosphorus. An unexplained increased reading was obtained in 1 case, and 4 patients with inflammatory lesions showed increased radioactivity over the inflamed areas.

Skin surface measurements of radioactivity made over cellular types of primary breast carcinoma, axillary and cervical metastases, and local recurrent carcinomatous nodules, all exceeded by more than 25 per cent measurements over apparently normal tissues. Measurements over ulcerated, infected carcinomatous lesions were markedly increased. Measurements over microscopic malignant lesions, mucoid carcinomas, and deeply situated lesions in obese breasts were comparable to those over normal breast tissue.

It is pointed out that the method of study described provides useful data for the clinical, radiologic and pathologic study of breast lesions. It cannot be used at this time therapeutically.

Eight drawings; 3 tables.

Tissue Localization and Excretion Routes of Radioactive Dibromestrone. Gray H. Twombly, Leslie McClintock, and Morris Engelman. Am. J. Obst. & Gynec. **56:** 260–268, August 1948.

The authors give the results of their experiments with dibromestrone, which they prepared by bromination of equilin with radioactive bromine 82. Their conclusions are briefly summarized:

(1) Dibromestrone is weakly estrogenic if at all.

(2) Dibromestrone is not selectively localized in the adrenals, spleen, uterus, ovary, or testes of the rabbit but occurs in the gallbladder within six hours after injection.

(3) Dibromestrone is not selectively localized in the liver, ovaries, or uterus of the female monkey or in the uterus of the dog.

(4) It is excreted largely through the common bile duct into the intestines. From this organ it may be reabsorbed into the portal circulation, ultimately to find its way to the kidney and into the urine.

(5) Solubility tests are consistent with the hypothesis that dibromestrone is excreted into the bile and into the urine largely as a conjugated phenolic steroid.

(6) These observations strongly support the theory of an enterohepatic circulation of dibromestrone and by implication, of other steroids as well.

Two drawings. JOHN DECARLO, JR., M.D.
Jefferson Medical College

Methods of Application of Radioactive Isotopes to Anticancer Research. G. Joyet. Schweiz. med. Wchnschr. **78:** 708–710, July 24, 1948. (In French)

This is a rather superficial discussion of the use of radioactive isotopes in cancer therapy (rather than in research). It is the belief of the author that there are two principal means by which this modality may be employed: (1) injection of the active isotope as such into the organism, with an attempt by any appropriate means to secure localization in the tumor; (2) introduction of a stable element into the organism and/or tumor, followed by *in vivo* bombardment with slow neutrons to secure radioactive transmutation. These methods are outlined to give direction to future research, but no original work is reported.

Two drawings; 2 tables. LEWIS G. JACOBS, M.D.
Oakland, Calif.

Isotopes and Radiation Hazards. Frank Howarth. Lancet **2:** 51–53, July 10, 1948.

Under the headings skin effects, blood changes, genetic effects, sterility, and effects of ingestion, the author reviews briefly the dangers of undue exposure to radioactive isotopes. Many of the articles quoted appeared orginally in RADIOLOGY.

EFFECTS OF RADIATION

Laryngeal Chondronecrosis Following Roentgen Therapy. William A. Goodrich and Maurice Lenz. Am. J. Roentgenol. **60:** 22–28, July 1948.

Laryngeal chondronecrosis following roentgen therapy for cancer of the larnyx occurred in 28 of 205 patients treated at the Presbyterian Hospital, New York City, between 1932 and 1946. Of the 28 patients, 8 were free of carcinoma, 2 showed persisting cancer, and in 18 patients it was not known whether or not disease persisted. Chondronecrosis developed within six months after the last roentgen treatment in most of the patients (23 of the 28). It was more prone to occur in extensive lesions (27 of the 28 were extensive), and to develop when limited surgery had been performed either before or after roentgen therapy. Laryngofissure or partial laryngectomy seemed to favor the development of chondronecrosis (excision of the free portion of the epiglottis and total removal of all the cartilage by laryngectomy excepted). In the authors' experience the chondronecrosis was usually so extensive that it was difficult to determine the point of origin. It involved the epiglottis more frequently than other laryngeal cartilages. Hautant's observations (Ann. d. mal. de l'oreille, du larynx **46:** 1198, 1927) indicated that the lower angles of the anterior borders of the thyroid cartilage were the most common site of chondronecrosis.

The prognosis in patients with chondronecrosis following roentgen therapy is poor when the necrosis involves the base of the epiglottis, the pre-epiglottic space, and arytenoids or thyroid cartilages. Prognosis is good when only the tip of the epiglottis is involved.

The use of chemotherapeutic and antibiotic agents, such as penicillin and sulfonamides, seemed to help abort the threat of chondronecrosis, but was of little value when the condition had developed. Laryngectomy should be considered in patients with early or impending chondronecrosis.

The most important observation made by the authors, in so far as roentgen therapists are concerned, is that the technic of roentgen therapy in patients in whom chondronecrosis developed did not differ from that used in the more successful cases. The authors

did gain the impression, however, that the larger the fields and daily dose and the shorter the period of treatment, the more frequently did laryngeal edema appear after therapy. Severe laryngeal edema, in its turn, was at times a precursor of chondronecrosis.

Details of treatment in the cases constituting this series are given. It is suggested that doses much larger than 100 r in air, daily to each of two lateral fields, 6 × 8 cm., with the usual 200 kv., 50 cm. target-skin distance, 0.5 mm. Cu filter, should preferably not be carried further than 500 r, or at most 1,000 r, to each field. Tracheotomy, when indicated, should be below the irradiated area, as it may otherwise permit the entrance of bacteria into the damaged cartilage and precipitate necrosis.

Two tables. JAMES C. KATTERJOHN, M.D.
Indianapolis, Ind.

Radionecrosis of the Mandible: Statistical, Pathogenetic, and Clinical Considerations. Franco Perotti. Radiol. med. (Milan) **34:** 321–342, June 1948. (In Italian)

Forty-eight cases of necrosis of the mandible occurred in 150 patients treated with radium for endo-oral carcinoma. The author points out that the necrosis of the mandible does not predispose to recurrences. Most patients were permanently cured of their carcinoma.

Six charts. CESARE GIANTURCO, M.D.
Urbana, Ill.

Complications of Deep X-ray Therapy of Carcinoma of the Lung. Victor C. Jacobsen. Am. J. Med. **5:** 148–156, July 1948.

A case of squamous-cell carcinoma of a right primary bronchus with complicating bronchitis, bronchiectasis, pneumonitis and emphysema is reported. The neoplasm was relatively small but because of its strategic location gave clinical symptoms over a period of nearly three years. During this long interval it remained within an area roughly 2 × 3 cm., grew slowly in the peribronchial tissue, and even invaded regional veins which built up a protective thrombosis, again holding the tumor within a narrow hilar zone. The hilar lymph nodes were not involved.

Four months before death, deep roentgen therapy (10,400 r divided among four portals) was instituted, repeated bronchoscopic examinations up to that time having failed to reveal the neoplasm (a mass was visible on the roentgenogram about eighteen months previously).

Postmortem examination revealed a specific x-ray effect upon the pleura, subpleura, alveolar and vascular structures, and very definitely upon the tumor itself. Hyaline necrosis of the peripheral zone of the tumor would seem to be a characteristic effect. The tumor was still viable in the central core, but fragmentation of cells was occurring in the areas in which the dosage of rays was of sufficient depth. The tumor was of the keratinizing type and hence somewhat radioresistant. The effect of the irradiation on the tumor, then, was good as far as it went. The changes in the pleura and lung parenchyma were, of course, deleterious.

While intensive treatment of bronchiectasis is imperative in preserving life in patients with lung cancer, in the present case there is no evidence that the bronchiectasis was favorably influenced by the two courses of deep x-ray irradiation.

Since pulmonary infection is common, the use of penicillin and/or sulfonamides or streptomycin should be the rule, whether or not radical surgery or deep x-ray therapy is employed. This may at least improve the patient's general condition and thus add to the life expectancy, as well as make him a better operative risk.

Four roentgenograms; 4 photomicrographs; 2 photographs.

Intestinal Changes Secondary to Irradiation of Pelvic Malignancies. Jerome M. Maas. Am. J. Obst. & Gynec. **56:** 249–259, August 1948.

A series of 600 cases of malignant growths of the pelvis—squamous-cell carcinomas and adenocarcinomas of the cervix, adenocarcinomas and sarcomas of the corpus uteri, ovarian carcinomas, and primary carcinomas of Bartholin's gland—treated by irradiation in the State of Wisconsin General Hospital over a period of thirteen years is reviewed. The method of therapy in these cases was determined jointly by the Departments of Gynecology and Radiology.

Immediate or transient complications consisted chiefly of radiation sickness, which was present in 87 per cent of the patients treated.

Permanent rectal changes, consisting mainly of fistitial proctitis were found to occur in 11 per cent of the cases treated. These changes occurred most frequently at the rectosigmoid junction and their management was grossly unsatisfactory for the most part. Further permanent rectal damage of diminishing frequency consisted of irreversible rectal stenosis, rectovaginal fistula, and secondary carcinoma of the bowel. It was noted that higher doses of radiation therapy tend to produce permanent rectal lesions earlier in the course of treatment and of a more serious nature.

The author demonstrates that when a diagnosis of a malignant neoplasm is made, with a thorough investigation of the most satisfactory mode of therapy to be used, subsequent complications can be predicted with a fair degree of accuracy. However, far too frequently the arrest or even complete cure of a cancer is obscured by the damage inflicted to surrounding tissue by x-rays and radium therapy, particularly the latter.

Three tables. ROBERT H. LEAMING, M.D.
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Influence of Age on Susceptibility of Mice to the Development of Lymphoid Tumors after Irradiation. Henry S. Kaplan. J. Nat. Cancer Inst. **9:** 55–58, August 1948.

This paper reports a group of experiments on irradiation of strain C57 black mice exposed to whole-body roentgen irradiation at ages ranging from two weeks to four months. Fractional doses totaling 750 or 1,000 r were administered in consecutive daily treatments. The rate of irradiation was 84 r daily. The incidence of lymphoid tumors thus produced decreased as the age at which irradiation was performed was advanced. A group of curves clearly demonstrates this on adequate numbers of mice to make these results statistically acceptable.

Two graphs; 1 table. S. F. THOMAS, M.D.
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